

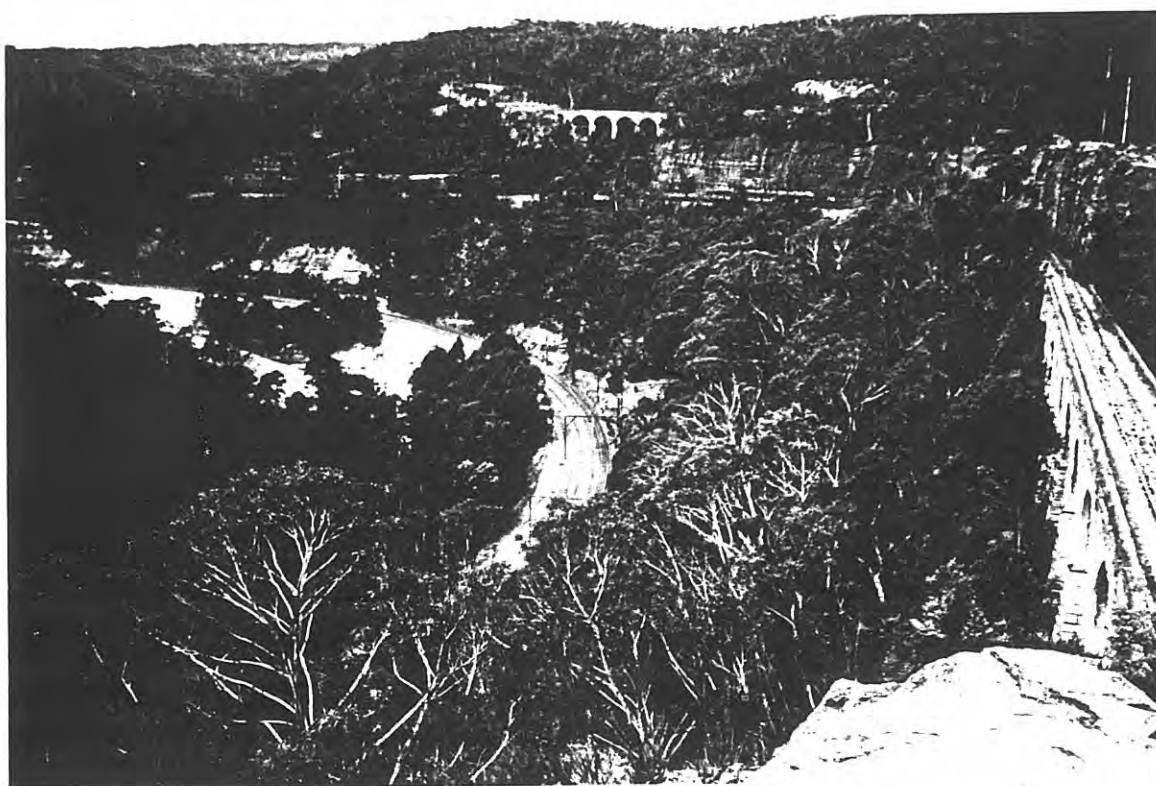
Institution of Engineers, Australia

PROPOSAL TO LANDMARK THE

# GREAT ZIG ZAG LITHGOW

AS A

NATIONAL ENGINEERING LANDMARK



Engineering Heritage Committee  
Sydney Division, I E Aust  
REVISED NOVEMBER 1991

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A tourist attraction



Division of Department of Conservation and Land Management

Dr D J Fraser  
C/- 14 Derby Street  
VAUCLUSE NSW 2030

BB:DF  
BOB BOSCHMAN  
(063) 32 8368

Dear Sir

**RE: SPELLING OF ZIG ZAG**

I refer to your correspondence of 6 September 1991 with regards to the "official" spelling of the title Zig Zag.

The Geographical Names Board (GNB) has only assigned one name after the particular feature and that is Zig Zag Public School located in Lithgow. Note that it is clearly two words and not hyphenated.

Because no other geographical feature has been recognised this would best reflect the GNB's view. The railway name is not one that has been addressed by the GNB as it is a cultural feature.

Should you have any enquiries concerning this issue, please do not hesitate to contact me.

Yours faithfully

Bob Boschman  
for Chairman

18/9/91



THE NOMINATION

THE CITATION

A SAMPLE BROCHURE





## Commemorative Plaque Nomination Form

To:  
Commemorative Plaque Sub-Committee  
The Institution of Engineers, Australia  
11 National Circuit  
BARTON ACT 2600

Date: November 1991  
From: Engineering Heritage  
Committee  
Sydney Division  
(Nominating Division or Branch)

The following work is nominated for an \*Historic Engineering Marker/National Engineering Landmark award:

Name of work The Great Zig Zag, Lithgow

Location, including address and map grid reference if a fixed work between Clarence and  
Lithgow (see National Trust documents in submission)

Owner Zig Zag Railway Co-Operative Ltd.

In support of the nomination the following information is provided:

For an ~~Historic Engineering Marker~~ Information plaque

(1) Proposed wording ~~as follows~~ as per attached or as modified

(2) Justification - please make data as complete as possible.#

### For a National Engineering Landmark (NEL)

(1) Date of construction (or other significant dates). 1867/69 - 1910 - to the present

(2) Names of key professional personnel associated with the work.# John Whitton, Engineer-in-Chief, NSW Railways  
1856 - 1890.

(3) Historic engineering significance of the work.# A railway engineering work of world standing at the time of its construction and during 40 years of operation.

- (4) Comparable or similar works (a) in Australia (b) overseas.#  
 (a) and (b) see documentation
- (5) Features or characteristics setting the work above other engineering works.#
- (6) Contribution towards the development of engineering and/or the nation.#
- } see attached documents

### For all Nominations

The following documentation is attached in support of the nomination:  
 (List all documents, photographs, etc, and enclose black and photographs).

The nomination has been discussed with the owner of the work who has indicated

.....  
 Letter of agreement attached

.....  
 (Include statement regarding owner's attitude)

A copy of this submission has been sent to the Secretary of the .....

Division at .....  
 (For completion by a nominating body other than a Division)

In the event of this nomination being approved the nominating body will organise an suitable presentation/ unveiling ceremony.

*P. Hagenbach*  
 .....  
 (Chairman of Nominating Committee)

*I. G. Bowie*  
 .....  
 (Secretary of Nominating Committee)

\* Delete as appropriate

# Where there is insufficient space, attach additional papers

# ZIG ZAG RAILWAY CO-OP. LTD.

A Non-profit Community Advancement Society.  
Registered under the N.S.W. Charitable Collections Act.

P.O.Box 33  
Woodford, N.S.W. 2778.  
Australia.

29/9/90

The Institution of Engineers, Australia,  
11 National Circuit,  
Barton CT 2600.

I.E. Aust. N.O.

**- 3 OCT 1990**

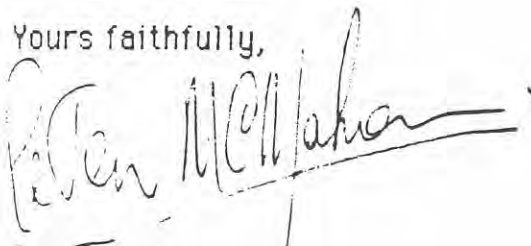
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Dear Sirs,

The Board of the Zig Zag Railway has unanimously agreed to your request to landmark the Great Zig Zag as an historic site.

Would you please advise the Board of the procedures necessary to achieve this end. If you need input from the Board, please don't hesitate to contact us.

Yours faithfully,



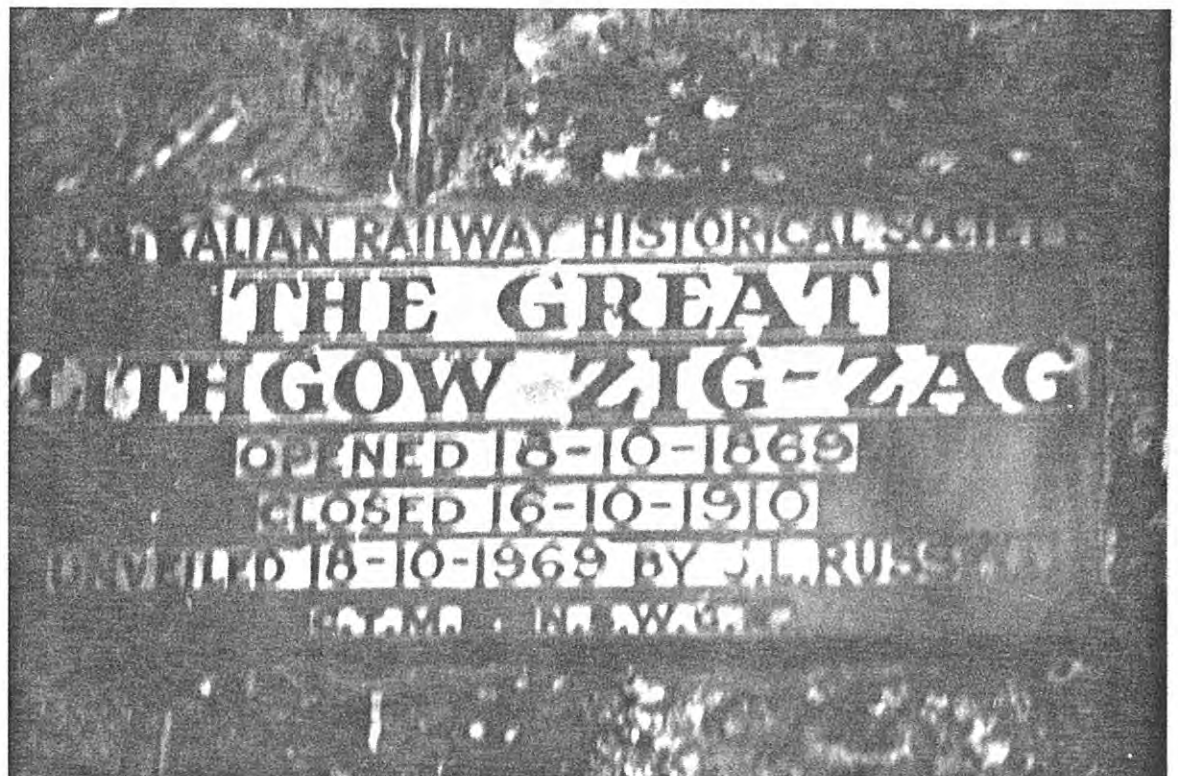
Peter McMahon,  
Secretary

I E Aust  
Crest

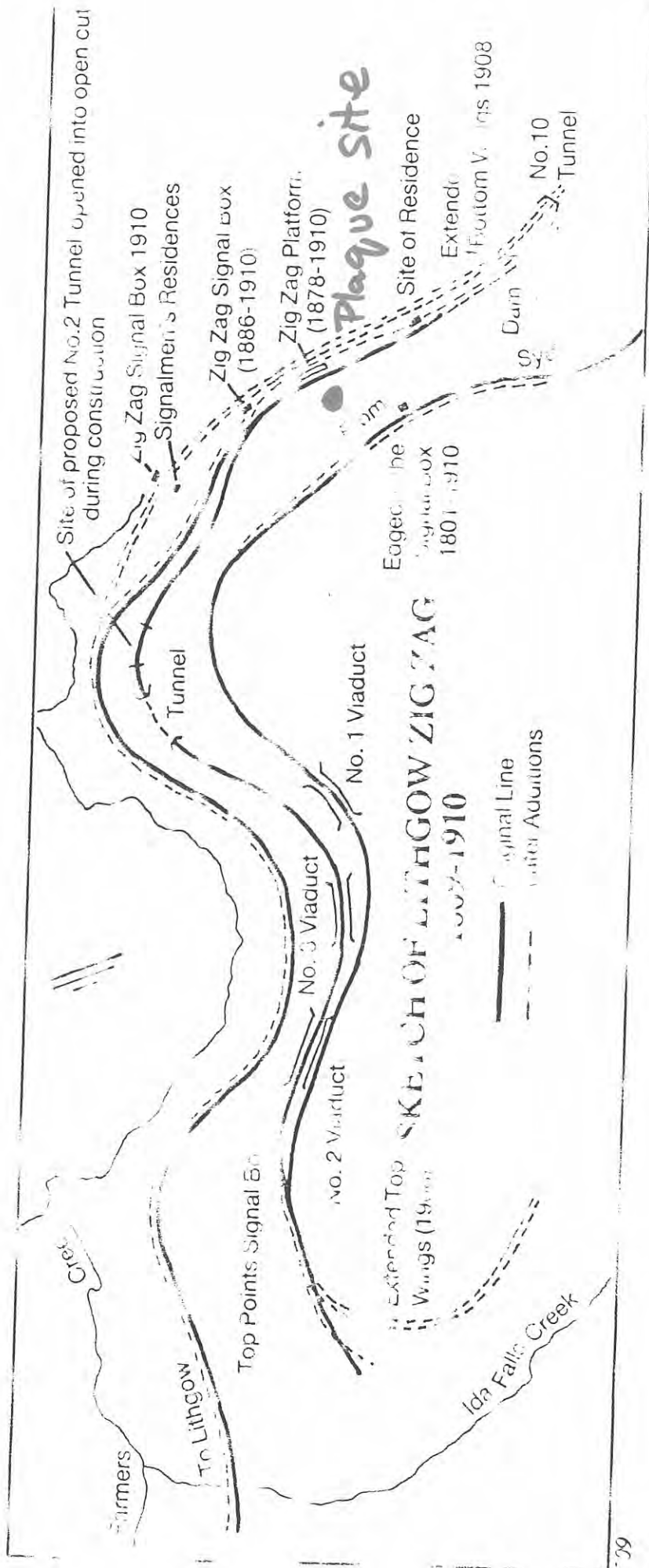
## THE GREAT ZIG ZAG LITHGOW

A ZIG ZAG IS A SERIES OF REVERSING RAMPS. JOHN WHITTON, ENGINEER-IN-CHIEF, N S W GOVT RLYS, CHOSE THIS AS THE ECONOMICAL METHOD FOR THE RAILWAY TO DECEND FROM CLARENCE TO LITHGOW. BUILT DURING 1866-69 BY CONTRACTOR PATRICK HIGGINS IT INVOLVED MASSIVE ROCK EXCAVATIONS, A TUNNEL AND THREE STONE ARCH VIADUCTS, AND ACHIEVED WORLD FAME. DURING ITS 41 YEARS OF OPERATION THIS GREAT ENGINEERING WORK OPENED UP THE FULL POTENTIAL OF WESTERN NEW SOUTH WALES.

DEDICATED BY THE INSTITUTION OF ENGINEERS, AUSTRALIA  
1992



This plaque is attached to the portal of the tunnel on the middle road



## OTHER CITATIONS AND CLASSIFICATIONS

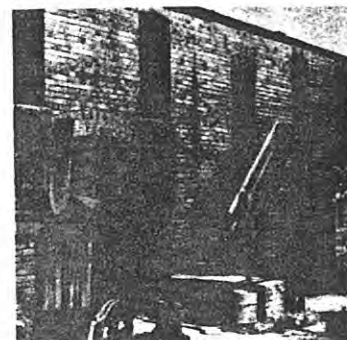
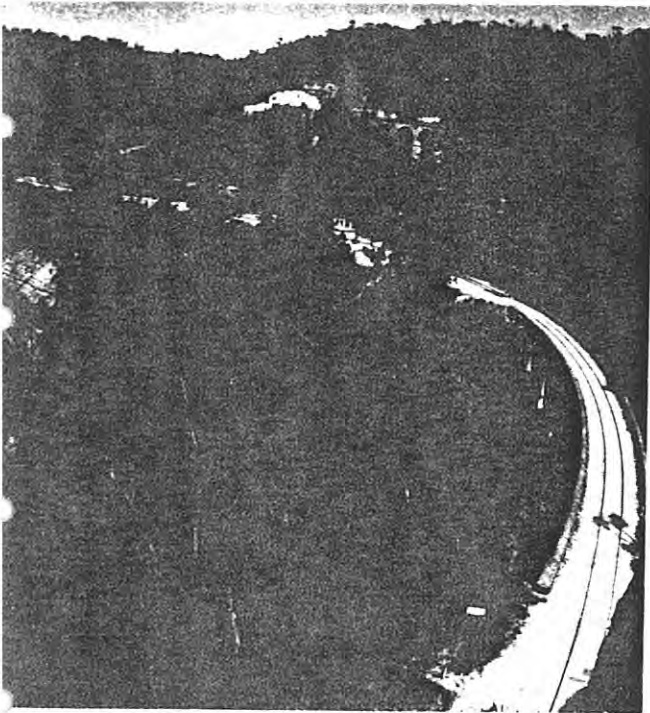
# THE HERITAGE OF AUSTRALIA

The Illustrated Register of the National Estate



Published by The Macmillan Company of Australia  
in association with the Australian Heritage Commission  
supported by H. C. Sleigh Limited  
CRA Limited





**on', including the two  
homes and stable block  
Road, Bowenfels**

orey sandstone house built in  
by Andrew Brown, a pioneer  
Lithgow area. The cast-iron  
is supported by wooden  
galvanized iron roof has two  
ically placed chimneys. On  
e of a six-panel front door are  
g bay windows with a central  
window and four-sash win-  
ve. A stone stable block and  
l garden houses still remain  
property. This is a good  
of a symmetrical Late Vic-  
ouse typical of the district,  
in important pioneer family.

**on' (formerly the Royal  
including brick  
ings and grounds  
Western Highway (adjacent  
ial School)  
Is South**

-storey dressed sandstone  
(c. 1845) with attic, built by  
Lennan as a store and resi-  
dence bought by George Lee and  
to an hotel. An eight-bay  
runs the full length of the  
l is supported on fluted tim-  
b. Doors are generally six-  
windows are six-paned, and  
ginal joinery remains. The  
ir building at the rear is of  
tone footings, with iron roof  
chimney. A well-preserved

early building which, when an hotel,  
was a Cobb & Co. changing station.

**'Fernhill', and outbuildings  
(formerly the Australian Arms  
Inn), including trees, grounds and  
front fence**

**Great Western Highway (at the top  
of Riverlet Hill), Bowenfels South**  
Originally built as an inn (c. 1858) by  
John Blackman, this single-storey  
dressed stone building has a double-  
pitched hipped roof with covered  
stepped verandah on three sides. The  
separate kitchen wing contains a large  
central kitchen with ovens, fireplace,  
dining room and laundry, all linked by  
a single verandah. The large rectangular  
stables building is constructed of  
rubble sandstone with dressed quoins  
and lintels; arched doorways lead to  
coach space, stables and harness room.  
A well-built early roadside inn, which  
formed an important link in the chain  
of wayside inns that stretched from  
Sydney to the western goldfields.

**The Great Zig Zag Railway  
Structures, embankments with  
reserve and area of Zig Zag  
reserve itself (approximately 220  
ha) excluding post World War II  
reserve shelter sheds. Between  
Clarence and Lithgow, 11 km west  
of Bell**

An historic section of the Great West-  
ern Railway connecting Clarence and  
Lithgow in which trains descend 70

metres from Clarence to the Lithgow  
valley amid spectacular scenery. It was  
designed by John Whitton, engineer,  
Chief of the Railways of NSW from  
1857 to 1889, and commenced by  
Patrick Higgins, in 1866. It was  
heralded worldwide as an engineering  
marvel when, on 18th October 1869,  
the first official train ran across the Zig  
Zag to Bowenfels.

At the time the alternative means of  
negotiating the steep and rugged in-  
cline were by constructing a 3 kilo-  
metre tunnel. Economic constraints  
and technical difficulties in tunnel  
construction in these early times effec-  
tively ruled out this solution and  
forced John Whitton to devise a less  
expensive means. Between 1869 and  
1910 the railway was a major force in  
the development of the western part of  
New South Wales, after which the top  
and middle sections were superseded  
by 10 tunnels.

Early in 1881 the entire area was  
declared a Public Reserve, thus ensur-  
ing the preservation of the magnificent  
scenic surrounds which offer superb  
views of the rugged sandstone valley  
and escarpments leading to the west-  
ern plains and serving to provide a  
dramatic juxtaposition to the urban  
development of nearby Lithgow sub-  
urbs. Today the railway is owned by  
the Zig Zag Railway Co-op Ltd. and is  
to be used as a tourist attraction,  
employing historical steam engines  
and carriages to take passengers

through the old train route which still  
includes three viaducts, all structurally  
sound and constructionally pleasing.

The Zig Zag Railway is, even today,  
regarded as an important example of  
Australian railway construction work.  
That its natural scenic advantages  
should also be made available to the  
general public once more is to the con-  
siderable good fortune of lovers of his-  
toric railways and fine scenery.

**Ironworks blast furnace site  
Eskbank, Lithgow**

This was the site in 1875 of the Esk-  
bank Ironworks Company, which  
after changing hands several times,  
finally closed down in 1930. The exist-  
ing ruins include large scale brick  
structures with a network of under-  
ground tunnels, a large slag heap, the  
blast furnace base, and the founda-  
tions of other associated buildings.  
The site has considerable historical  
interest as it was where the first steel  
was tapped in Australia in 1900. The  
surviving structure is both visually  
dramatic and industrially important.

**Eskbank House and outbuildings  
including grounds, trees and  
Historic Society collection  
Bennett Street, Lithgow**

A single-storey dressed sandstone cot-  
tage built in 1842 by Thomas Brown, 12  
the founder of the coal industry in  
Lithgow. It is symmetrical in layout  
with four main rooms and hall sur-



BRANCH MANAGER'S REPORT NO. 462 /88  
OF 22 NOVEMBER 1988

Item No: 6(iii)

GREAT ZIG ZAG, LITHGOW:  
PERMANENT CONSERVATION ORDER

INTRODUCTION:

At its meeting of 4 June 1987 the Heritage Council recommended to the Minister the making of a permanent conservation order for this railway work, together with a recommendation for an interim conservation order. The interim order was made on 22 January 1988. Due to the technicality of s31 of the amended Heritage Act, the Minister cannot actually make the permanent order until a further report is made by the Heritage Council. Accordingly, this report recommends that the Heritage Council resubmit its recommendation for a PCO to the Minister.

CRITICAL DATES:

2. The current ICO expires on 22 January 1989.

DESCRIPTION AND HERITAGE ISSUES:

3. The previous report to the Heritage Council (Annexure A) remains up-to-date on description, heritage and planning matters. The Great Zig Zag is an item of historical, aesthetic and scientific significance to the State and nation and an item of international scientific significance. Protection under the Heritage Act is warranted as a statement of its outstanding significance and to control the impact of tourism upon the site. Since the Heritage Council's initial consideration, formal advice has been received from the owners of the Reserve, the Lands Office, that no objection is held to the making of a PCO. The other affected parties, the Reserve Trustees, the Zig Zag Railway Co-operative and the State Rail Authority have all indicated strong support for the order. No objections have been received. The SRA has opened the platform at Zig Zag Signal Box (bottom points) as a station in its public timetable. Exemptions under s57 as for the ICO are proposed.

PLANNING ISSUES:

4. The Manager, Western Regions Branch, Department of Planning, has advised as follows.
5. A PCO would enhance protection afforded to the area, necessary to ensure future planning, development and management. It helps to sustain the item as an attraction to tourists which is important for the local economy. The status given to the item by the PCO will also be useful in promotion of the area for tourism and recreational use. On planning grounds, the making of the PCO is therefore supported.

CONCLUSION:



5. It is recommended that the Heritage Council reaffirm its previous resolution that a PCO be made for the Great Zig Zag, Lithgow.

RECOMMENDATION:

6. It is RECOMMENDED that the Heritage Council:
- pursuant to S.35A of the HERITAGE ACT*
- (i) recommend to the Minister the making of a permanent conservation order in respect of the item known as the Great Zig Zag and its site being the Lithgow Valley Reserve, City of Greater Lithgow, as shown edged heavy black on the plan catalogued HC 1434 in the office of the Heritage Council of New South Wales; and
  - (ii) recommend to the Minister pursuant to section 57(2) of the Heritage Act, 1977, that he grant an exemption from the provisions of section 57(1) in respect of the engaging in or carrying out by the owner, mortgagee or lessee of the land of the activities set out in the Schedule.

SCHEDULE

- . the maintenance of any building or works on the site where maintenance means the continuous protective care of existing material;
- . eradication of noxious plants and animals;
- . maintenance and repair of existing access roads;
- . tree lopping and vegetation clearance associated with the maintenance of existing overhead power lines; and
- . the engaging in or carrying out of any of the activities referred to in subsection 57(1) of the Heritage Act, 1977, in respect of the repair and maintenance of train-operation infrastructure.

  
  
 R. POWER  
 Manager  
 Heritage Branch

5.12.88

Prepared by: A.M. Prescott, Historian  
 File No: HC 31135

Date

NEVILLE JEFFRESS/PIDLER PTY LTD  
Box 4276, G.P.O. Sydney 2001

# ZIG ZAG HERITAGE ORDER

David Hay, Minister for Local Government and Minister for Planning, has made a permanent conservation order on the famed Great Zig Zag Railway, and the surrounding Lithgow Reserve.

The order was made on the recommendation of the Heritage Council of NSW.

The official declaration of the heritage order was made in a ceremony at the Zig Zag on Tuesday, attended by representatives of the Zig Zag Railway, Zig Zag Trust and City Council.

The Minister, announcing the conservation order, said Zig Zag is an item of 'historical, aesthetic and scientific significance' to the State and nation, and is also an item of international scientific significance.

"Protection under the Heritage Act is warranted as a statement of its outstanding significance and to control the impact of tourism upon the site," Mr Hay said.

The making of a permanent conservation order has the support of the Crown Lands Office, the Reserve Trustees, the Zig Zag Railway Cooperative and the State Rail Authority.

Extensions have recently been carried out to the tourist railway which operates on the Zig Zag and extensive earthworks have been completed along Chifley Road to extend the railway to a new terminus east of the old Clarence Tunnel.

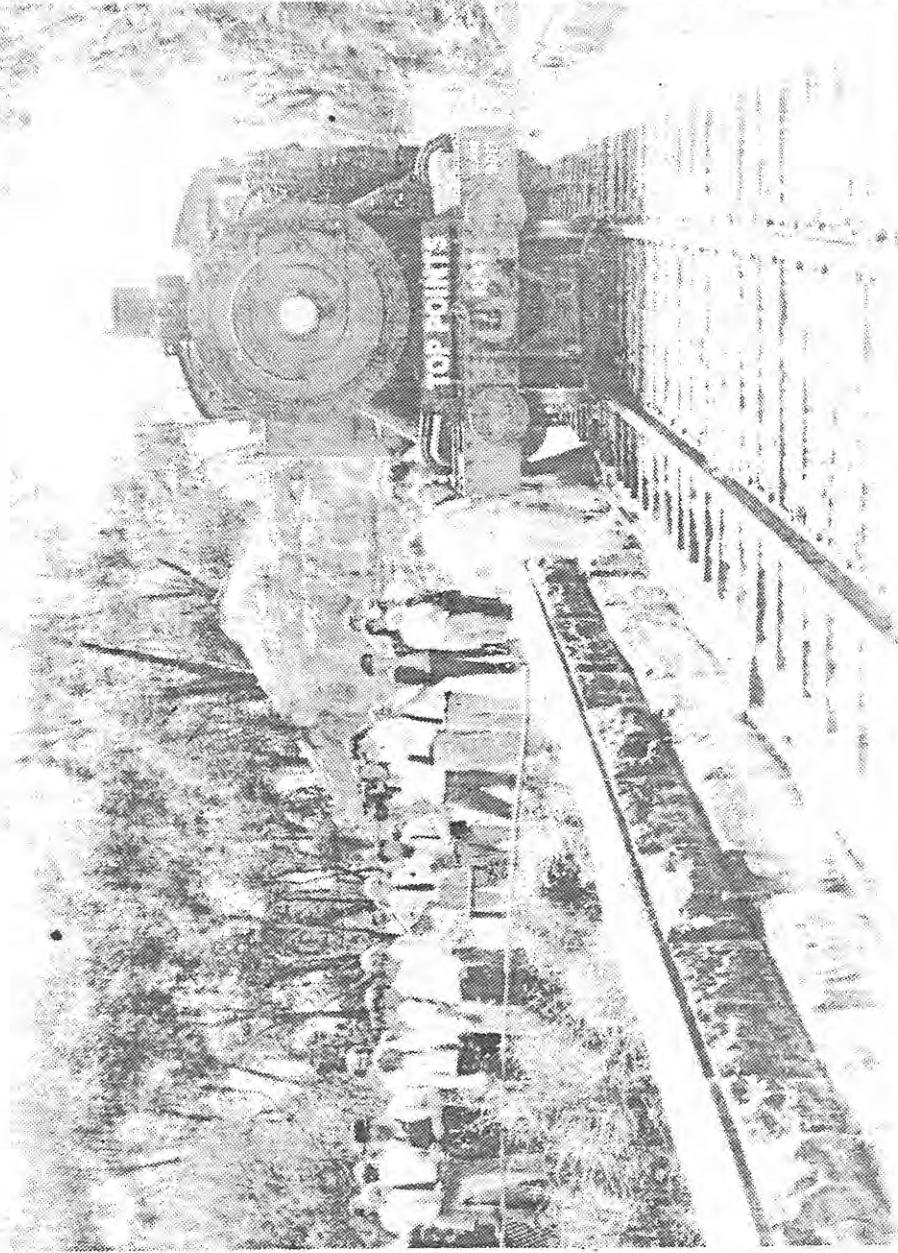
The Great Zig Zag Railway (so-called to distinguish it from the Little Zig Zag at Lapstone) was built between 1863 and 1869.

The name "Zig Zag" aptly illustrates how trains entering and leaving the Lithgow Valley had to swing this way and that to negotiate the steep western slopes of the Blue Mountains, before the railway tunnels were constructed.

Mr Hay said The railway is recognised as the greatest work of the Engineer-in-Chief of the NSW Railways, John Whitton (1819-1898).

Whitton, "father" of the State's rail system, was responsible for the construction of over 2,000 miles (3,500 km) of railway, and is recognised as being among the top 20 railway civil engineers in the first century of world railway construction, he said.

The contract for building the Great Western Railway between Clarence and Wallerawang was given to Patrick Higgins.



• Pictured: The Minister, official guests and members of a large metropolitan and local Media contingent rode the steam train over the Zig Zag route during the ceremony and are pictured at a vantage point

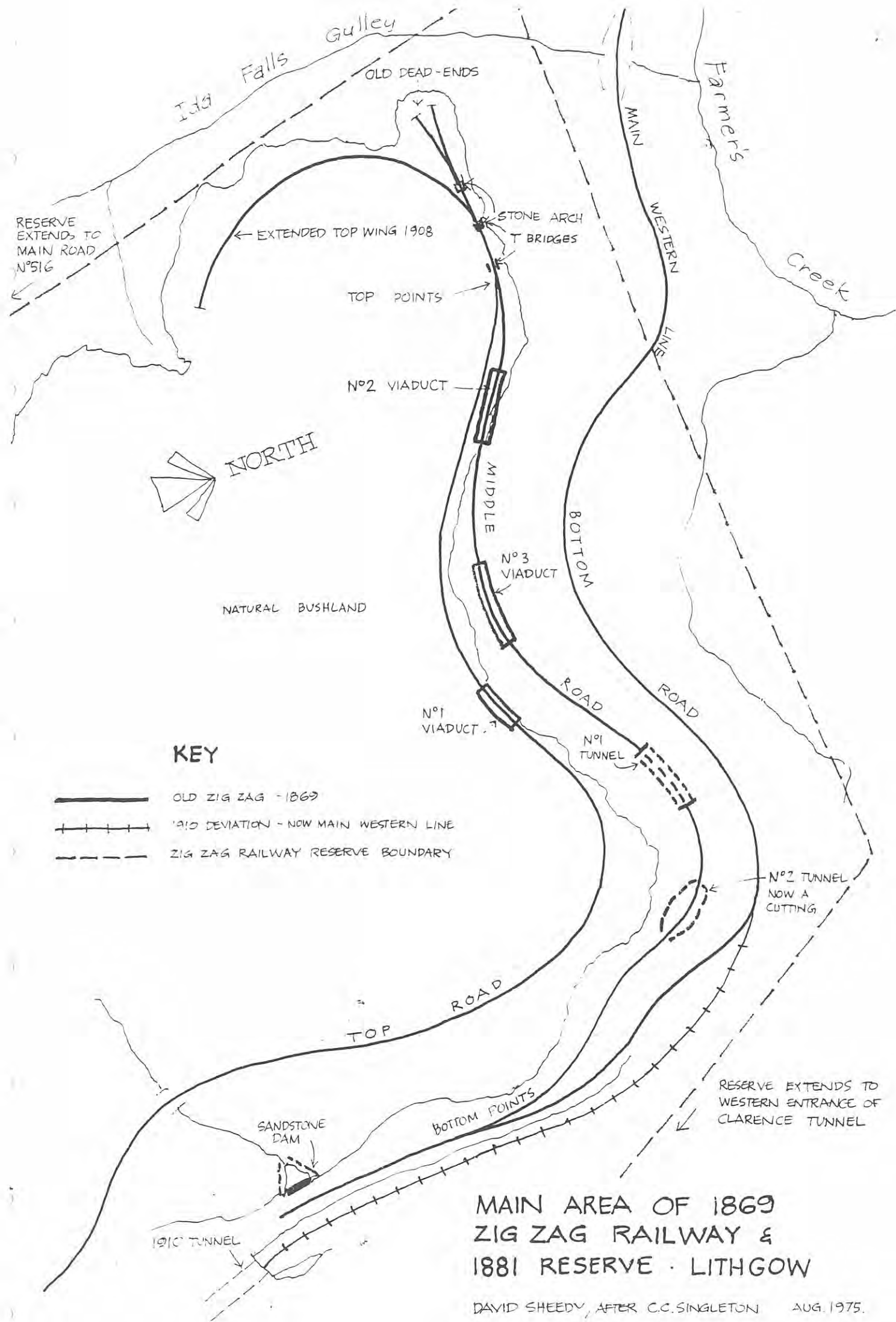


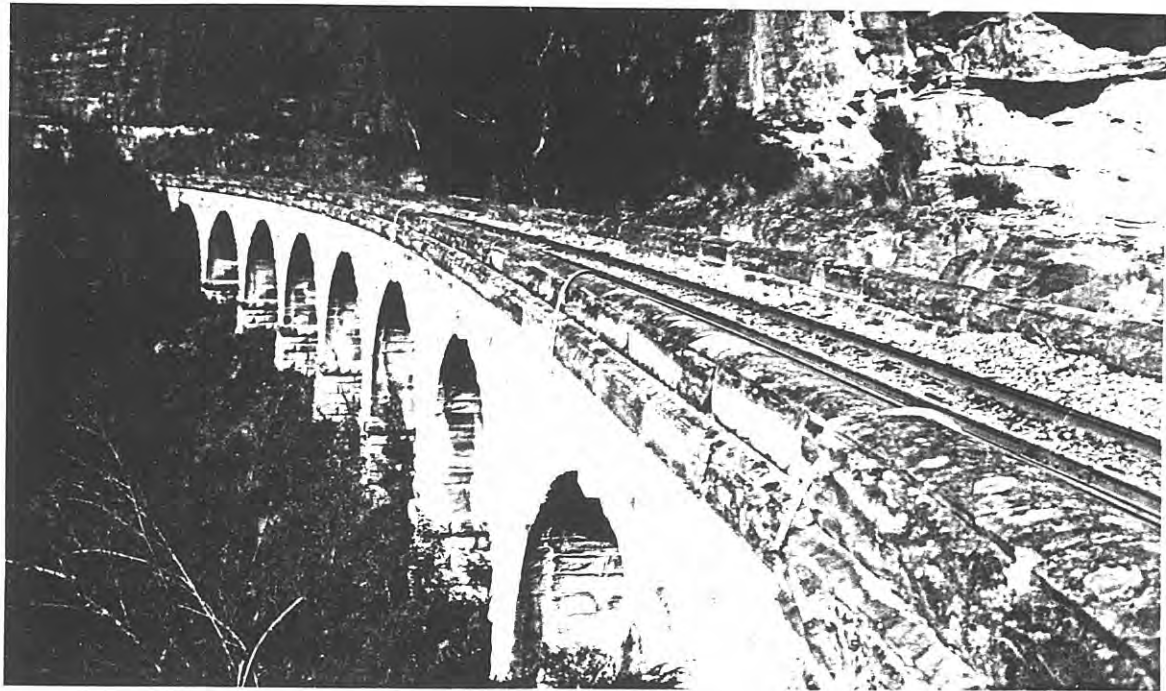
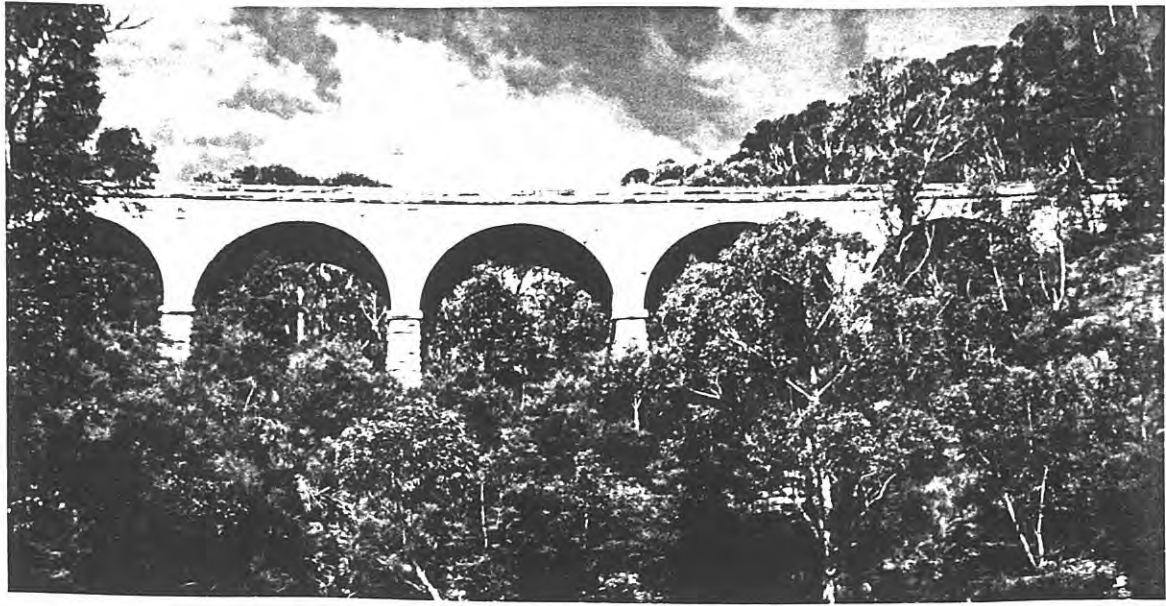
|  |  |  |  |   |  |
|--|--|--|--|---|--|
| LITHGOW  |  | THE GREAT ZIG ZAG RAILWAY<br>STRUCTURES, CUTTINGS, EMBANKMENTS<br>WITH RESERVE AND AREA OF ZIG ZAG<br>RESERVE ITSELF (approx. 550 acres)<br>excluding<br>Post W.W.II Reserve Shelter Sheds         |  | Between Clarence and<br>Lithgow<br>11 Km West of Bell   |  |
| (Town or District)   |  |  |  |   |  |
| Post Code 2790   |  |  |  |   |  |
| Local Govt Area<br>LITHGOW CITY COUNCIL  |  |  |  |   |  |
| Author of Proposal<br>J. Lesslie<br>M. Klam  |  |  |  |   |  |
| Date of Proposal<br>A. Cargill<br>6/8/75   |  |  |  | GRID AMG 1000m<br>REF 8931-397926   |  |
|  |  | (Name or Identification of Proposed Listing)<br><b>NT (NSW)</b>  |  | (Address or Location)   |  |
| Suggested Listing Category<br><b>CLASSIFIED</b>  |  | Bibliography<br>Bayley, W.A. <u>Lithgow Zig Zag Railway</u><br>Blue Mountains N.S.W., Bulli, Austrail<br>Press, 1973 (3rd Ed.)<br>Pictorial History of Australian Rail-<br>Ways, Landsdowne Press. |  | Owner and Address<br>Advised - 5.4.76<br>Zig Zag Reserve Trust<br>Secretary<br>Mr. W. Simpson<br>22 Finlay Avenue<br>Lithgow 2790 |  |
| Committee (Trust Use)<br>/AC   |  |  |  |   |  |
| Council (Trust Use)<br><b>APPROVED CL</b><br>24/2/76   |  |  |  |   |  |
| Description<br>Briefly cover the points on the following check list where they are relevant and within your knowledge.   |  |  |  |   |  |
| Style<br>Construction<br>Use<br>Architect/s<br>Builder/s<br>Date of Construction<br>Present Condition<br>History<br>Owners<br>Boundaries of proposed listing   |  |  |  |   |  |
| <p><b>Historical:</b> The Zig Zag section of the Great Western Railway was a method devise to bring trains down the sharp 220' descent from Clarence to the Lithgow Valley. At the time of its construction, difficulties in tunnel construction and the cost thereof were factors in a decision against the building of the proposed 2m tunnel</p> <p><b>Date:</b> The contract for the Clarence-Wallerawang section of the Great Western Railway was let to Patrick Higgins in 1866. The first official train ran across the Zig Zag to Bowenfels on the 18th October 1869.</p> <p><b>Designer:</b> John Whitton, Engineer in Chief of the Railways of New South Wales from 1857 to 1889.</p> <p><b>Original Owner:</b> N.S.W. Government Railways<br/>Declared a Public Reserve 1881<br/>Top and Middle Roads superseded by 10 tunnels constructed 1910</p> |  |  |  |   |  |

Reasons for listing

- 1) At the time of building the Zig Zag was regarded worldwide as an engineering marvel and still ranks as an important railway construction work in Australia.
- 2) The three main viaducts are particularly pleasing structures and remain in excellent condition.
- 3) The reserve is a fine scenic attraction in itself, offering superb views of the rugged sandstone valleys and escarpments leading to the western plains and serves to provide a dramatic juxtaposition to the urban development of nearby Lithgow suburbs.
- 4) The provision of the Railway in period 1869-1910 saw it assisting the major developments in the western part of the state at that time.









#### THE ZIG ZAG TRUST

The following notes have been compiled from many sources, particular acknowledgement is made to the Australian Railways Historical Society, the N.S.W.G. Railways Archives and Mr. C.C. Singleton.

#### THE LITHGOW OR GREAT ZIG ZAG

The construction of the railway to the west of N.S.W. posed many difficulties, the principle one being finance, agitations were afoot cheap horse tramways along the roads of the colony instead of conventional railway construction. The second difficulty was the physical ascent and descent of the Blue Mountain ridge, the most practical route for the railway. Mr. John Whitton, Engineer in Chief of the N.S.W.G.R. from 1857 till 1889, was faced with the almost impossible task of finding a practical and economic route up, along and over this ridge. Construction costs were kept to an absolute minimum, this resulted in a route which contained sharp curves and extremely steep grades, 1 in 33 being abundant. The initial rise onto the ridge was accomplished with a "switchback" or Zig Zag at Lapstone, this being known as the Lapstone or Little Zig Zag.

Trial surveys were run in a number of locations west of Mt. Victoria, to find a suitable descent off the main Blue Mountain ridge, these included proposals to cross the Hartley valley and the main Gt. Dividing Range to Sodwalls. Finally Whitton settled on two alternates, after having crossed the Darling Causeway from Mt. Victoria to the hills associated with Mt. Clarence, firstly, the descent to the Lithgow valley by means of a tunnel 2 miles long at an estimated cost of \$800,000. This tunnel would have required 10,000,000 bricks, 4 years to construct and no contractor was prepared to undertake the work. This led to the second scheme of a Zig Zag similar, but larger than the Lapstone one. The cost estimate was \$340,000, the difference would allow considerable construction in flatter country further west.

The line followed a ridge west from Clarence and then northerly to the extremity of a spur where it reversed into the gully, finally reversing again to reach the floor of Lithgow valley. These notes will only deal with that part of the line west of Clarence and the entry to the valley of Lithgow.

#### THE CONSTRUCTION CONTRACT

At a point  $\frac{1}{2}$  mile west of Clarence tunnel (elevation 3658', 1617' long, grade 1 in 66) in May, 1866, Mr. Patrick Higgins was granted the contract for the construction of the next 15 miles to Wallerawang, the first 4 miles included the construction of the Zig Zag. This consisted of the most extensive rock cuttings yet attempted, building 2 (later 1) tunnels, 3 large viaducts 1 small viaduct and numerous culverts, all were to be built of locally quarried sandstone, from Burtons quarry near Mt. Sinai (see map), and set in Portland cement mortar.

The first section of this contract was opened down the Zig Zag to Bowenfels and from Mt. Victoria with the passage of a passenger train dep. Sydney at 9 a.m. arriving at Bowenfels at 2-45 p.m. on 18th., October, 1869. Sidings were incomplete for goods trains and it is recorded that the opening was "without public ceremony".

#### THE DEVIATION TO REPLACE THE ZIG ZAG

Train working on the Zig Zag was always difficult and hazardous and at various times proposals were advanced to eliminate it, ultimately on 10th., October, 1910, a  $\frac{1}{2}$  mile deviation of double track and containing 10 tunnels on a greatly reduced grade of 1 in 90 was opened and the Zig Zag passed into history. This deviation has never been completed, the deviation joined the Bottom Road of the Zig Zag at Bottom Points, an extra 2 tunnels were proposed on the whole of the original 1 in 42 grade of the Zig Zag would have been eliminated. The close proximity of a large locomotive depot at Lithgow to provide helper engines mitigated against its completion. The scheme had a revival in the early 1950's but it was again shelved following the electrification of the line in 1957.

#### THE ROUTE

On leaving Clarence tunnel (open to the public) the old formation has now been taken over by the Main Road No 516 for  $\frac{1}{2}$  a mile around Mt. Sinai, the road leaves the formation which passes through a deep curved cutting. A side access road then joins the formation, this is sealed for the next mile. The descent at a grade of 1 in 42 is northerly through a curved cutting to Edgecombe, at this point a crossing loop and signal box was established on 29-10-1901 to divide the section, Clarence to Top Points.

Beyond Edgecombe through 2 small cuttings and past a permanent rock spring the line crosses No 1 Viaduct (2-15', 5-30' arches, 10 ch. curve) to

(2)

gain a ledge cut in the sandstone rock, the line now being known as the Top Road. The view from this point shows the 3 levels or Roads very effectively i.e. Top, Middle & Bottom Road, the latter being the present railway.

Following the Top Road the first reversing point is reached, this is Top Points, numerous alterations were made at this point to facilitate train working. Originally there was only one reversing siding rising away from the points at a grade of 1 in 66 to terminate at a precipice overlooking Ida Falls gully, 500 ft. below. On 3-6-1884 signalling was provided and on 1-7-1895 an engine run around was provided to eliminate the need to propel or push trains on the Middle Road. On 23-5-1908 an extended wing was opened to accommodate full length goods trains, thus eliminating the need to divide and re-marshall trains at Lithgow and Clarence, provision was thus also given for trains to cross. On the original wing was a single arch stone viaduct. The new wing entailed a long cutting on a 7 chain curve, 60' deep necessitating the removal of 70,000 cu. yds of rock, this work was carried out despite the commencement of the 1910 deviation.

From Top Points on the second level or Middle Road, No 2 Viaduct (9-30' arches, straight, highest pier 75') is crossed. After crossing the viaduct the line follows a narrow ledge produced by a blast of  $3\frac{1}{2}$  tons of blasting powder removing 40,000 tons of rock. This blast was the first in Australia to be fired electrically.

The line then crosses No 3 Viaduct (8-30' arches, 10ch. curve) and a ledgewas followed to No 1 Tunnel (225', 8ch. curve) through a steep spur on the mountain to the site of No 2 Tunnel, this was actually cut, but it was decided to open it out during construction. The tunnel was 148' long. It was opened by an electrically fired blast of  $3\frac{1}{2}$  tons of powder removing 45,000 tons of rock. This was fired by the Countess of Belmore in the presence of the Governor and a large body of spectators. The cut so formed is 135' high. The Middle Road then ran up into the gully to the lower reversing point Bottom Points, this was opened with the line as a single reversing siding and a stone cottage was provided for the "pointsman", this was removed in the construction of the 1910 deviation. On 15-4-1878 a siding to allow trains to cross was added and a platform for tourists was provided. The line from this point to Bowenfels, the Bottom Road was duplicated on 21-10-1880, this being necessary because of the development of numerous industries and sidings in the Lithgow Valley, this was the first country main line to be duplicated in N.S.W. Following this, Bottom Points signalling and point interlocking was installed on 17-3-1886, engine run around was provided on 15-7-1895 and the wing was extended to accommodate full length goods trains on 17-5-1908. Watering facilities for assistant locos was provided from a 3,000,000 sandstone dam at the head of the gully.

The Bottom Road descends into Lithgow down the gully, still on the 1 in 42 grade, the present line joining it just beneath No 1 Tunnel. No direct road access is available down the gully to Lithgow. This grade, now known as the Zig Zag bank, prior to electrification in 1957, presented a magnificent sight as heavy goods trains ascended it. Frequently these were hauled by 3 locomotives and pushed with one, the noise of the multiple exhausts was deafening.

#### ACCIDENTS ON THE ZIG ZAG

Due to the steep grades frequent misty and foggy weather and poor visibility around the sharp curves there was always hazardous train working conditions, particularly into the Top Points dead end.

On 4-4-1901 at Sp.R., B Class loco No 246 (later 2542, scrapped 1937), descending from Clarence with 36 trucks and a Van, got out of control, climbed over the buffers and ascended the rock parapet overlooking Ida Falls gully remaining suspended over the precipice until towed clear by 2 other engines. The driver and fireman jumped clear in time. A large concrete stop was erected to prevent a similar occurrence, this is still in existence as also are the wheel marks in the rock behind it.

A portion of the rear of a goods train stopped at Clarence tunnel broke loose on 8-9-1908, ran through Edgecombe, and crashed into a stationary train at Top Points, the runaway stripped the side from the stationary engine and the trucks piled all over it. The brakevan with 3 passengers miraculously remained unscathed on the line. A bale of wool from one of the trucks struck the guard of the other train killing him. The wreckage then caught fire and it started to snow thus adding to the confusion of passenger transshipment on the mail trains later.

#### THE ZIG ZAG RESERVE

The Zig Zag, because of the magnificence of the engineering and masonry, became a popular spot for visitors, as already mentioned, a platform was opened at Bottom Points to cater for their needs. Because of this an area of



(3)

about 550 acres was set apart as a Public Reserve (see map) on 14-3-1881. This area covers a tract of country from Lithgow Valley to Clarence tunnel. When the new deviation was opened in 1910 the old formation soon became overgrown with vegetation and it was not until a tourist road, the present main road up Scenic Hill, was opened in 1939, that tourists again penetrated to explore the magnificence of the old viaducts and tunnels. The need for some control over the area became apparent and this was vested in the existing Hassans Walls Trust, by the N.S.W. Dept. of Lands. Shortly the Trustees will relinquish control of Hassans Walls and will administer the Zig Zag Reserve only.

On grants from the Lands Dept. the Trustees have attempted to improve the area, without interfering with any historic landmark, to provide tidy facilities for picnickers, maintain roads, construct tracks (similar to one under No 1 Viaduct) and provide information signs, etc. At this time (Apr. 1969) extensive work is proposed to prepare the area for its centenary on 18-10-1969.

Considerable expense is incurred by repairs necessary due to wanton vandalism and litterbugs.

#### TRAMWAY PROPOSAL

A group of enthusiasts, mainly based in Sydney, have proposed to establish a 3'-6" gauge tramway, initially to traverse the Middle Road on the Zig Zag. The Trustees have agreed to this broadly in principle only, the final acceptance is still subject to considerable negotiation. The second century of the Zig Zag may again see steam trains traversing it.

For further information on this subject please contact:-

Zig Zag Tramway Proposal,  
237 Pacific Highway,  
HORNSBY, 2077

#### FURTHER DETAILS OF ZIG ZAG HISTORY

These can be obtained from the N.S.W.G.R. Archivist, the Aust. Railways Historical Society Bulletin Nos. 252 & 253 of Oct. & Nov. 1958., also the Mitchell Library.

\*\*\*\*\*

Chairman of Trustees,  
Mr. A. Cargill,  
3 Shaft Street,  
LITHGOW? 2790

Secretary & Treasurer of Trustees,  
Mr. W.D. Allan,  
16 Birdwood Street,  
LITHGOW, 2790

\*\*\*\*\*

THE RESERVE BELONGS TO YOU PLEASE HELP TO KEEP IT TIDY AND

DO NOT DEFACE ANYTHING.

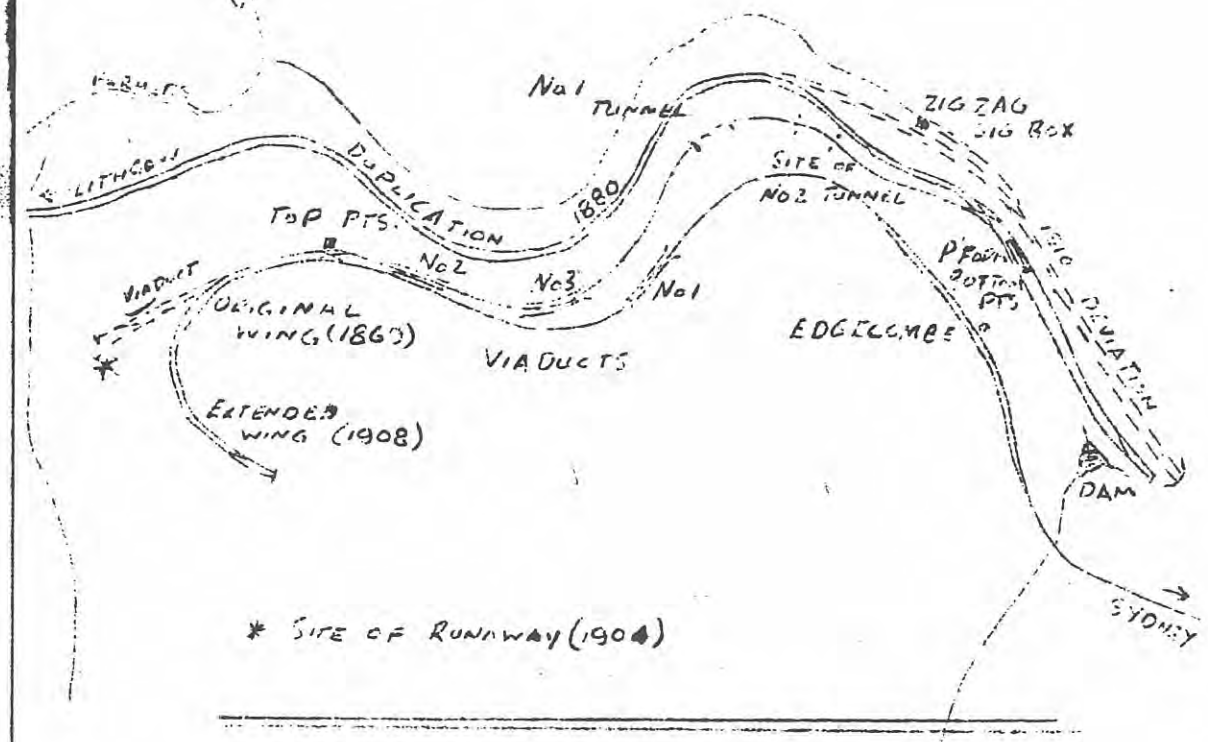
THE TRUST WILL NOT HESITATE TO PROSECUTE VANDALS AND LITTERBUGS

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*Map of the Zig Zag Reserve*

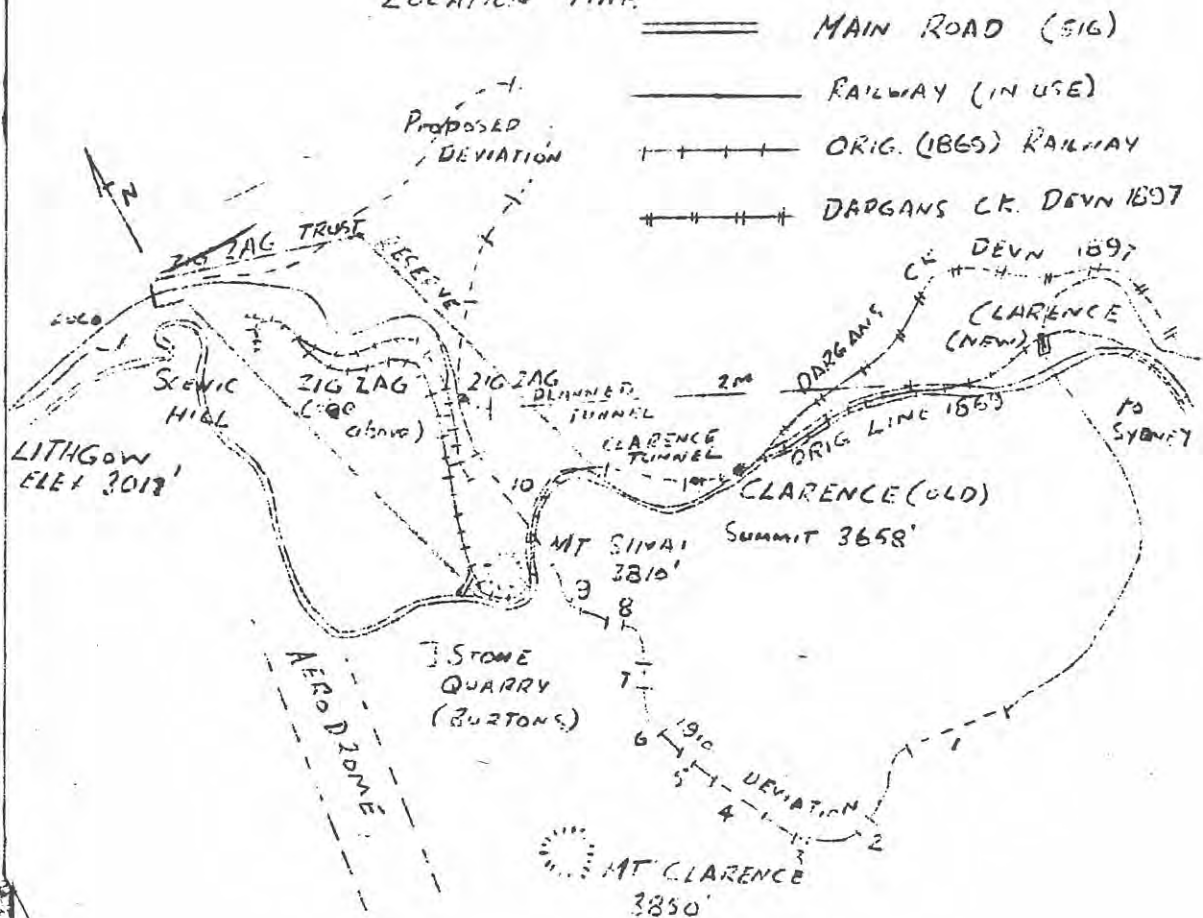


# ZIG-ZAG (1908)

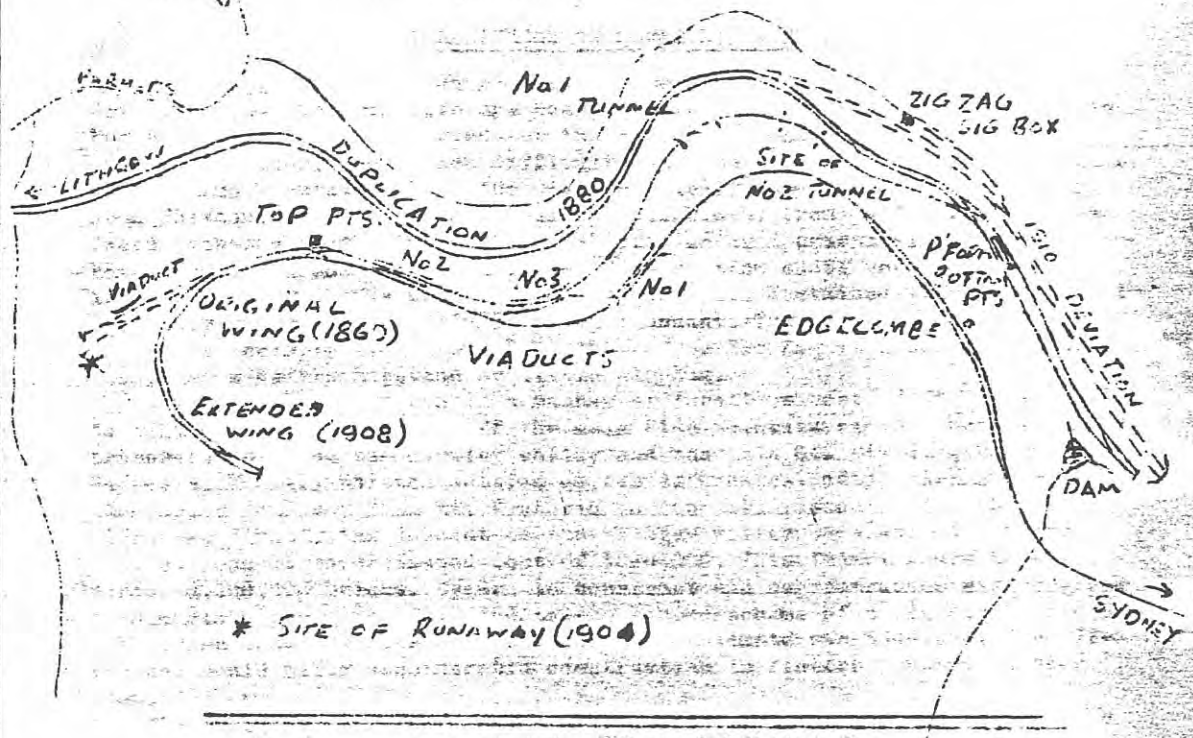


## ZIG-ZAG

### LOCATION MAP

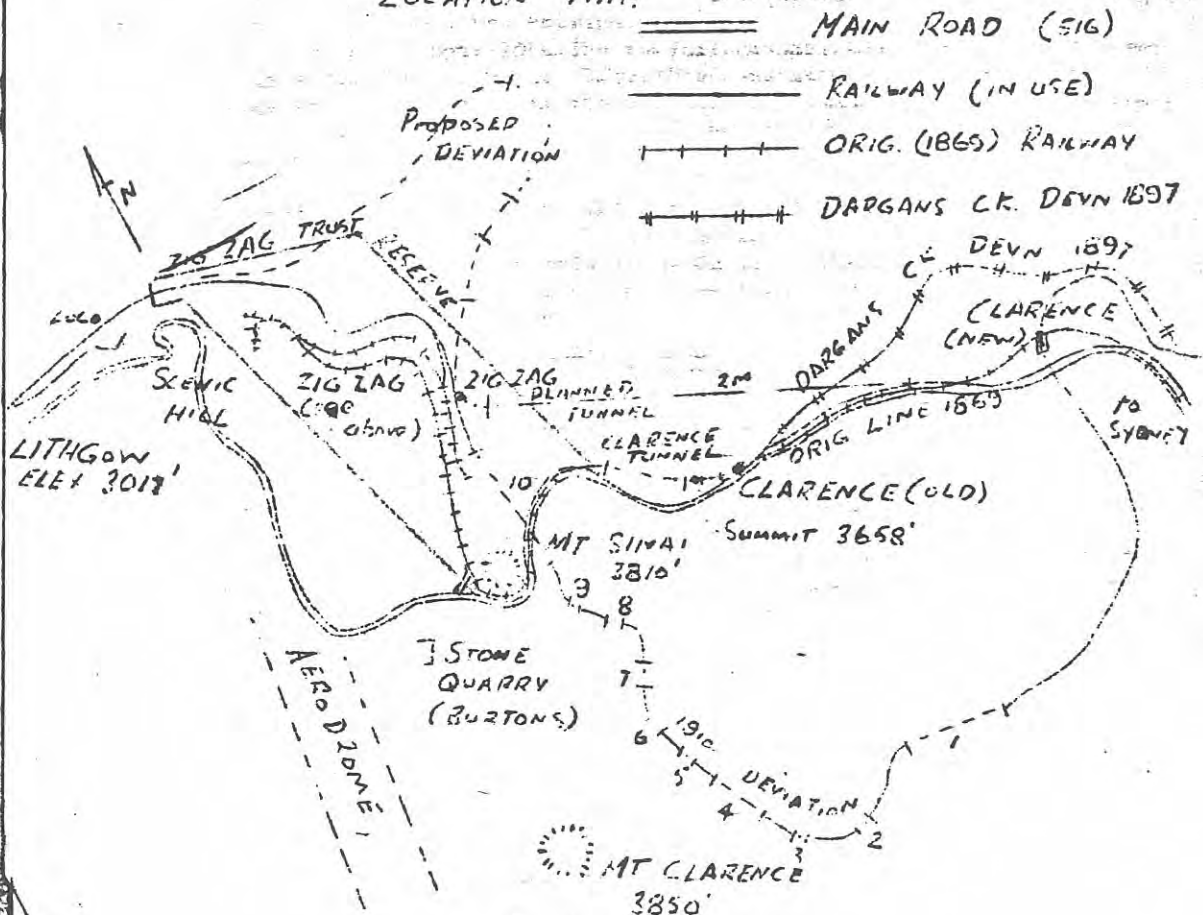


## ZIG-ZAG (1908)



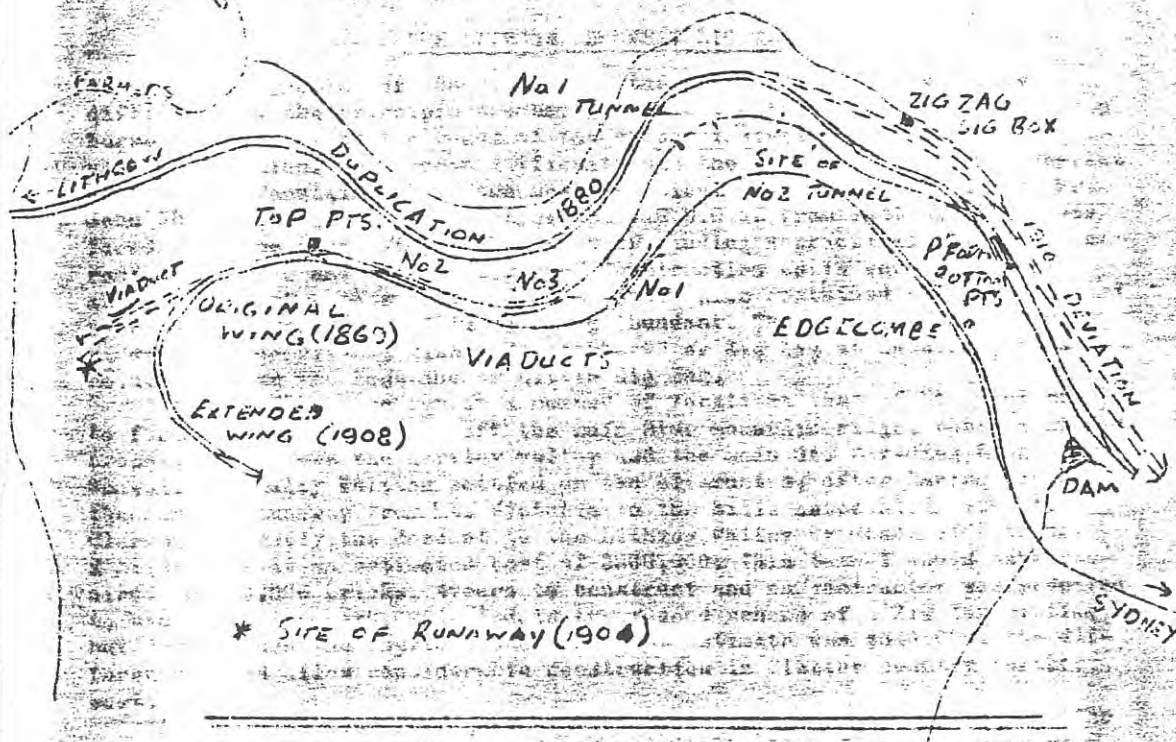
## ZIG-ZAG

### LOCATION MAP



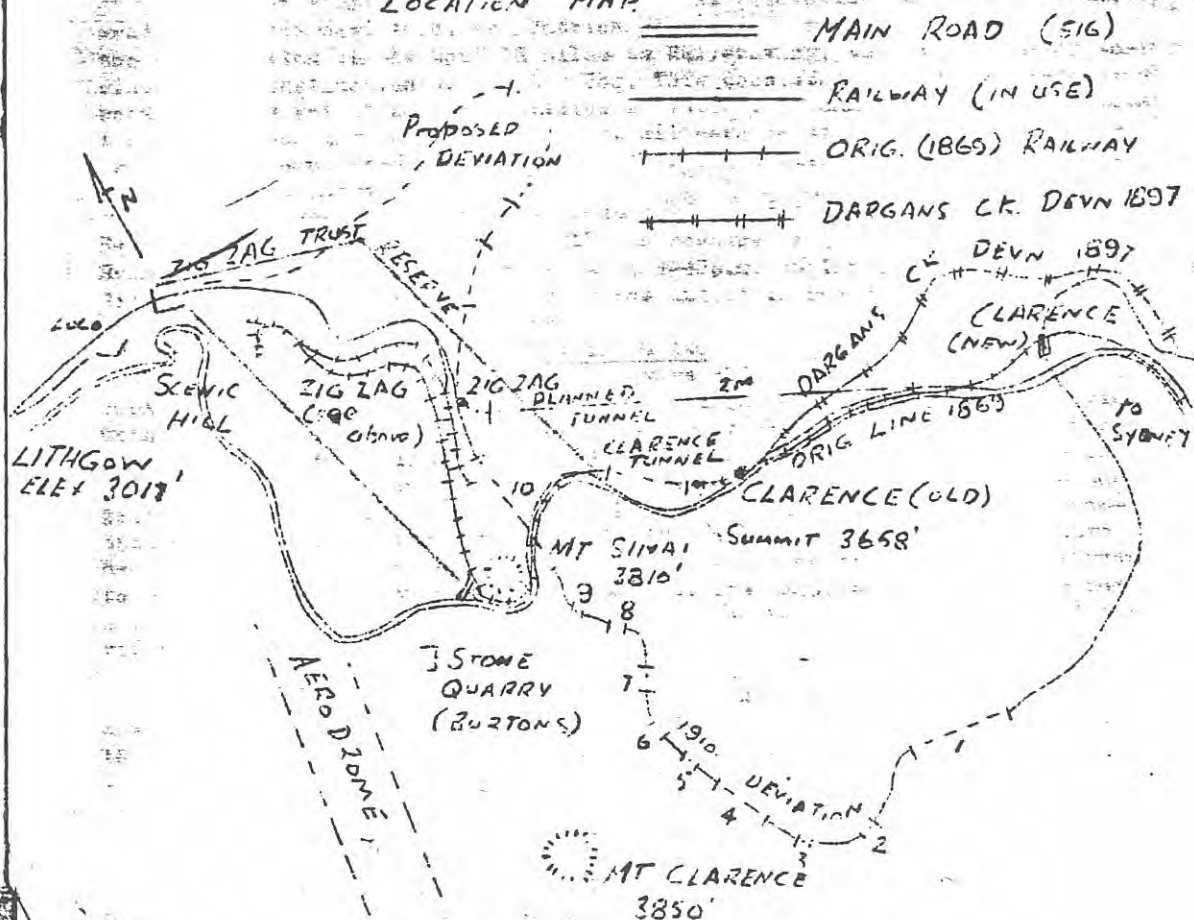


## ZIG-ZAG (1908)



## ZIG-ZAG

### LOCATION MAP



## PRIMARY REFERENCE SOURCES

## PRIMARY REFERENCE SOURCES

The Great or Lithgow Zig Zag was constructed at a time, 1867 - 69, when professional engineers in Australia wrote very few papers about their work for publications in technical journals. For example, there are scant references to their works in such respected world-distributed journals as THE ENGINEER and ENGINEERING.

In New South Wales, it was not until the 1880s with the appointment of Professor Warren to the Chair of Engineering at the University of Sydney that the regular publication of papers began in local journals such as the Engineering Section of the Royal Society, the New South Wales Engineering Association and the Sydney University Engineering Society, and overseas in the Proceeding of the Institution of Civil Engineers, London.

However, contrary to any suggestion of reluctance to write about their work, those early practising engineers were in fact prolific writers because most were in the employ of the Government, consequently they were required to write lengthy detailed reports at regular intervals, such as Annual Reports, plus those in response to specific requests from Governments, politicians and Commissions of Inquiry.

Their works were also under considerable public scrutiny and were constantly reported on in the newspapers (see later the collection of articles assembled by William A. Bayley).

The engineers and their works were also the subject of many articles in in-house journals of the Government Agencies, such as the NSW Railway and Tramway Magazine, often written by people who had first-hand knowledge of the items.

Collectively, these varied publications constitute the PRIMARY REFERENCE SOURCES for the story of the construction, operation and closing of the Great Zig Zag, and the most significant ones are cited on the next page.

The Zig Zag information, however, is scattered throughout these sources, but a succession of authors have done a considerable amount of sifting, collating and summarising of the information. Gradually, through this consolidated effort, the full merit of the Lithgow Zig Zag has come to be appreciated. This has enabled some authors to make comparisons against the backdrop of contemporary significant railway works elsewhere in Australia and overseas. Selected authoritative references by some authors form part of the primary source material.

Primary reference sources relative to the Great or Lithgow Zig Zag :-

Railway Extension (Report of Captain Hawkins on Surveys), New South Wales Votes & Proceedings of the Legislative Assembly, 1856-57, Vol III.

Report from the Engineer-in-Chief for Railways on Railway Extensions, NSW V & P of the LA, 1861 - 62, Vol II.

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Report from the Select Committee on Railway Extensions, NSW V & P of the LA, 1870, Vol II.

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Railway Correspondence and Reports, NSW V & P of the LA, 1875, Vol III.

Report on the Construction and Progress of the Railways of NSW from 1866 to 1871, by John Rae, Commissioner for Railways, NSW V & P of the LA, 1875-76, Vol IV.

Parliamentary Standing Committee on Public Works, Report on Proposed deviation to avoid the Lithgow Zig Zag, NSW V & P of the LA, 1894, Vol III.

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Vogel, F. F., The Railways over the Blue Mountains, NSW Railway and Tramway Magazine, Vol III, March 1920.

Gilder, G. A., The Early History of the Railways of New South Wales, Jnl, Royal Australian Historical Society, Vol XVII, Part IV, 1931.

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Lee, Robert., The Greatest Public Work, NSW Railways - 1848 to 1889, Public Works Department of NSW History Project, Hale & Iremonger, Sydney 1988 ( 7 references to the Zig Zag in the index).

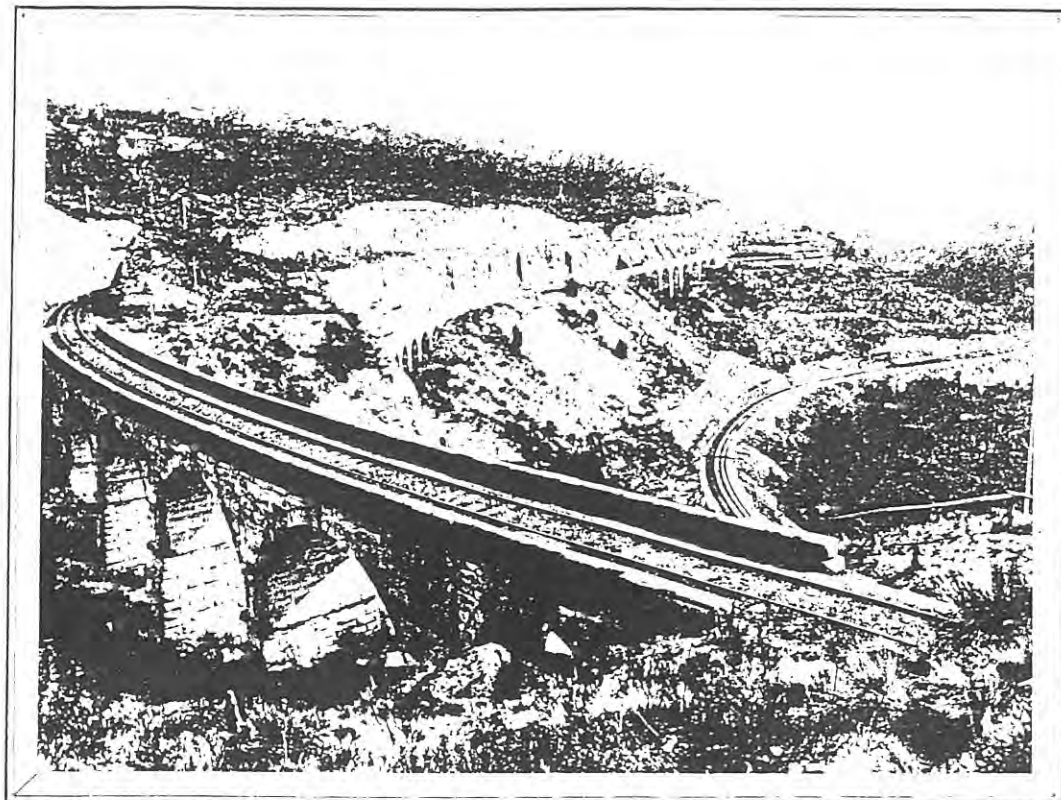
## HISTORICAL INFORMATION





WHAT IS THE LITHGOW ZIG ZAG ?

A SUMMARY OF ITS HISTORY



## AN OVERVIEW

### SOME HISTORICAL NOTES ON THE GREAT ZIG ZAG

by

Australian Railway Historical Society<sup>1</sup>

+++

The Lithgow, or Great Zig Zag, the particular piece of railway engineering that you will see today, was regarded at the time of its construction and for many years after as one of the wonders of the world. Its fame became world-wide and many visitors came from overseas to view it, whilst organised sight-seeing parties made it a favourite picnic spot for many years.

The construction of the railway line over that section of the Blue Mountains, between 1863 and 1869, was fraught with many difficulties. Financial stringency was very much in evidence and agitations were afoot for the cheaper construction of horse tramways along the road leading to the interior of the Colony, consequently the task of the then Engineer-in-Chief, John Whitton, was an unenviable one. Mr. Whitton has been rightly called "the Father of the N.S.W. Railways", for he held the office of Engineer-in-Chief for a period of 32 years 1857 - 1889, during which time he was responsible for the construction of over 2,000 miles of railway, thereby laying the foundations for the present State-wide system.

Because the cost of construction had to be kept to a minimum, the railway line over the mountains was constructed with steep grades and sharp curves, with the elevation on the East and West being achieved by means of zig-zags instead of the tunnels that were originally proposed by the Engineer in Chief. The smaller or "Little" zig zag on the eastern slope of the mountains (opened in 1867) was eventually replaced by a tunnel in 1892 but this, whilst it did away with the necessity for the reversing of trains, did little to relieve the hazards of train working because of its steep grade and bad reverse curves inside the tunnel. Engine crews were at times overcome by gas fumes and smoke, whilst the journey through the tunnel was always regarded by passengers as an ordeal. In 1913 a new deviation, via the Glenbrook Gorge, was brought into use to replace the steep grades and tunnel between Emu Plains and Blaxland.

To the West, the railway, after the consideration of several alternate schemes involving circling Mt. York, eventually followed the high ridge of the Darling Causeway from Mt. Victoria and it was originally proposed that the line would make its descent into the Lithgow Valley by means of a tunnel. This tunnel was estimated to be about two miles in length and at that time 1866, a figure of \$800,000 was set down as the cost of its construction. The tunnel proposal was abandoned; firstly, because of the enormous cost, the time that would have elapsed during its construction, and the fact that quite a few miles of line through open country could be constructed for the same cost; and secondly, as John Whitton reported at the time, it would be difficult to get a contractor to undertake the work. Accordingly, the zig zag method of descent was decided upon.

Turning to the accompanying map, it will be seen that the original line left the high ridge near Bell and descended into the valley of Dargan's Creek on a grade of 1 in 50, which means a fall of one foot for every 50 feet forward travel, and then ascended the other side of the creek for 1 mile 31 chains of stiff grade of 1 in 33 to the eastern portal of the Clarence tunnel. Clarence station, close by the tunnel, was the highest point of the old line (3,658 feet). Relief from the heavy 1 in 50 and 1 in 33 grades in this section was provided in 1897 by the construction of a deviation heading Dargan's Creek giving 1 in 60 grades (see map). From the western end of the Clarence tunnel, the line for most of the way descended in a continuous grade of 1 in 42 for five miles to the bottom of the Zig Zag, the top wing of which was about 220 feet above the level of the line down in the valley immediately below.

The Great Zig Zag consists of three sections - the "top road", the "middle road", and the "bottom road". Trains proceeded beyond the Top Points an extension or "wing" which terminated on the edge of a cliff overlooking a 200 feet drop. Here the train reversed and in the early days the engine propelled the train down the "middle road" to the bottom "wing", from which position it then proceeded along the bottom road and so on its way to the west. Later in the interests of safety the engine ran round the train and hauled the train all the way. Going in the opposite direction the procedure was reversed. Three very fine stone viaducts are on the Great Zig Zag, all of which are visible to present-day train travellers as trains travel along the line which is now located beside the original line.

The Great Zig Zag was included in a construction contract, beginning near the western end of the Clarence tunnel, and let to Mr. P. Higgins in May, 1866. This section represented one of the heaviest railway works of those early days. In the 15 miles from that point to Wallerawang, there were seven stone viaducts, varying in height from 10 to 70 feet, three tunnels, and nearly 1¼ million cubic yards of excavations, two-thirds through rock. The section was opened for traffic on 18th October, 1869 - a truly remarkable effort.

The working of trains over the Great Zig Zag was always hazardous, great caution having to be exercised on the descent of the middle road, on which there is a 230 feet tunnel. Eventually, traffic became so dense, due to the growth of the system and the loss of time in working over the Great Zig Zag, that consideration was finally given to its replacement. Throughout the last 20 years of the 19th century, many inquiries and investigations were held as to the best method in which to achieve this - several deviations being considered as well as John Whitton's original proposal for a two-mile tunnel - but it was not until 1908 that work was begun on the existing deviation with its 10 tunnels and easier grade.

In the meantime, the density of traffic demanded something should be done at the top and bottom "wings" of the Great Zig Zag as a relief until the new deviation was opened for traffic, with the result that the old top "wing" was abandoned in favour of an extension on a new location, the construction of which involved a sharp curve, heavy rock excavations and earth fillings to a depth of 60 feet, in order to get the required length of line. The bottom "wing" was merely lengthened without any re-location. On 16th October, 1910, the new deviation was opened for traffic and the Great Zig Zag became another historical monument.

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1. These notes are a collation of information from many references, principally the writings of G. G. Singleton (CV here) and of William A. Bayley (CV later).

**A TRIBUTE TO CYRIL CORBET-SINGLETON****Foundation President and Honorary Life Member**

With the sudden death in Canberra on 5th February of Cyril Corbet-Singleton ("Sing") the Society has lost both its foundation President, who served in that office for 20 years and an Honorary Life Member without peer.

"Sing", as he preferred to be called by his countless friends and associates of all ages, was a most knowledgeable gentleman with an outstanding memory for detail, while his vital interest and enthusiasm for the geography and history of Australia, especially as it related to railed transport, gained for him a large circle of friends, a circle which was drawn from all parts of the world.

He died at his daughter's residence and his remains were cremated at the Northern Suburbs



Crematorium (Sydney) on Tuesday, 9th February.

"Sing" was born on 5th June, 1888 at Burwood, a suburb of Sydney. His father was a South Australian mining engineer and his mother came from Sydney. At an early age he was taken to England where he became acquainted with the locomotive affairs of the then fascinating London, Brighton and South Coast Railway.

Returning to New South Wales as a very young man he became an apprentice with the engineering

firm of Messrs. Davies, Shepherd and Company and as a journeyman fitter engaged on drawing duties, he was later employed at the Garden Island Naval Depot. Here, he became interested in warships and was greatly impressed with the engineering marvels of the "H.M.S. ENCOUNTER" and the four-funnelled "H.M.S. POWERFUL".

A wide knowledge of the ferry boats plying Sydney Harbour was also gained at this period and it was delightful to hear him relate the everyday doings of the "paddle-wheelers", the "single-enders" and the "double-enders" of the various ferry companies' fleets of the early 1900s. He was also interested in overseas and coastal shipping, particularly the small steamers, known as the "Pig and Whistles", which plied the North Coast and South Coast ports of New South Wales.

In August, 1910, he entered the employment of the New South Wales Railway Department as a civil engineering draughtsman attached to the Per Way Branch (later the Way and Works Branch). Here, he became engrossed in the design of sidings and yard layouts and, as a side-line, he studied the manifold mysteries of safe-working systems, work of a most interesting nature and one that became a sheer pleasure to contemplate.

In the course of years he gained promotion to Assistant Engineer, Design, and Engineer and ultimately gained the position of Liaison Officer on an inter-departmental basis, a post which brought him into all phases of railway operation. He retired from the Department in June, 1953 on his 65th birthday.

It was about 1930 when, with Gifford Eardley, the late Malcolm Park and the late Arthur Dunstan, he proposed the formation of a society of men devoted to the everyday study of locomotives, rolling stock, and the history of railways throughout the length and breadth of Australia, and New Zealand. At this inaugural meeting it was decided to proceed with the formation of such an organisation, to be known as The Railway Circle, and in due course the first regular meeting was held in the Railway Institute at Devonshire Street, Sydney with "Sing" as the foundation President. The initial membership was small but from this beginning has grown the present Society as we know it to-day with Divisions in every State of the Commonwealth.

Following a suggestion that a monthly bulletin be published to record the findings of the Society, then known as the Australian Railway and Locomotive Historical Society, a single sheet was produced detailing local happenings of railway interest. This was followed a month later by Bulletin No. 1 in duplicated style, the progenitor of the present magazine.

"Sing" gloried in this new publication and contributed countless specialised articles, maps, and track layouts, all of which have proved to be of inestimable value to historians and railway enthusiasts.



iasts, not only in Australia but throughout the world.

"Sing" possessed an appreciative taste for light opera, particularly Gilbert and Sullivan. He sang and acted in the chorus of the Sydney Musical Society, the Mosman Musical Society, and was a foundation member of the well-known Savoyeurs Musical Society. Even in the last six months of his life he found time to associate with the Little Glee Club at the Mowll Memorial Village, where he resided.

His pet aversions covered inefficiency and ineptitude in highly placed "officialdom" and an intense hatred for the humble but potentially dangerous house-fly. On one occasion at lunch it was noticed that a plastic fly-swat was placed on the table at the side of his knife. All of a sudden he made a mighty swipe at an intruding fly, to its detriment, and looked with sheer amazement when an associate commented "Don't hit them like Sing, you'll kill them".

Those of us who were fortunate enough to have known "Sing" as a friend and benefactor (through his enormous contributions to the recording of the railway and tramway history of Australia) mourn his passing. He was in many respects unique as a senior officer of the New South Wales Government Railways, which to-day bear many marks of his genius, particularly in regard to track lay-out, train working and timetabling.

His encyclopaedic knowledge of railway lore and technical detail, his fund of anecdotes about railways in general and New South Wales in particular, being prodigious as well as entertaining, and his sparkling sense of humour, will long be attributes remembered by his innumerable friends.

Until 1929, the reports identified rolling stock items by their Commonwealth Railways' classification code, an ideal situation. Subsequently though, like items (old or new, bogie or 4-wheel) were grouped under one descriptive heading. By a process of logical deductions and perhaps a bit of 'low cunning,' it has been possible to discern the main changes that occurred between 1920 and 1939.

Starting with the passenger stock, we find the only vehicles listed until 1931 were the four 'Short Toms' from South Australia, the first class (NAP), two composites (NABP) and the second class (NBP) carriages providing the necessary accommodation on the regular mixed train.

The completion of the Birdum extension in 1929 threw into sharp relief the inadequacies of the 'Short Toms'. The Administration admitted that with their bare longitudinal seats, they were unsuitable for a 315-mile journey. To improve matters, a standard Commonwealth Railways' narrow gauge composite carriage (also coded NABP) was sent from Port Augusta in 1932.

This new bogie vehicle was 40' 2½" long over end platforms with bogie centres set 27' apart. Seats were still longitudinal but were broken by armrests while its capacity was given as 18 first class and 20 second class passengers. When re-assembled at Dar-

Even on the Wednesday before his death "Sing" told of his plans to "write up" the Great Northern Railway (N.S.W.) beyond Newcastle. He was quite enthusiastic over this new venture which will now have to be left in other hands. It is a pity that he did not survive to see his forthcoming book, dealing with the various road and rail crossings of the Blue Mountains, in print, but we will all appreciate the ability of his prose and the skill of his drawing pen when it does.

Undoubtedly, the Society was largely his original creation. He loved railways: they were his life and joy apart from his late wife and family.

The Society has lost a guiding hand and principal research officer, a friend and confidant of all who love railways.

At the funeral service Mr. Geoff Palmer's comments were appropriate —

"Many of his friends here to-day will appreciate that the passing of 'Sing' was just the way he would have wished it. A train trip to Canberra, a meal, relaxation in the company of his family, and a quiet slipping away. So, although each of us will feel a sense of personal loss at 'Sing's' passing, let us not be sad, but rather wish him well on this, his last journey to a new life."

Needless to say our Society was well represented amongst the many mourners.

We have lost a personal friend and will miss his unchanging enthusiasm and cheerfulness.

Vale "Sing"

(This composite tribute has been prepared from contributions from three close associates of "Sing", Messrs. John Buckland, Gifford Eardley and Alex Grunbach).

win the coupler height was found to be slightly higher than the existing stock and a special 'chopper' had to be devised to enable it to be coupled.

The first class 'Short Tom' (NAP), the old Administrator's car, was destroyed by fire on 23rd October, 1933, when sparks from the locomotive entered the carriage, setting it alight, but, it was not until 1938 that it was removed from the records.

At the end of the decade there were three composite and one second class carriages available.

Turning now to passenger brakevans, it will be remembered that the two former South Australian vans, now coded NHS, were still in service in 1920.

These were supplemented in 1924 by the addition of a Port Augusta-built bogie van (code NH). This vehicle, 32' 2" long and weighing 14 tons 7 cwt. 2 qrs., had the high elliptical roof favoured by the Commonwealth Railways and a small guard's compartment, with side look-outs at one end.

In 1933, another van coded NYB arrived from the south, being similar in dimension and outline to the earlier NH van. The main difference was a small second class passenger compartment at one end, 6' long and fitted with two transverse seats accommodating 8 passengers.

In August, 1935, the Commissioner instructed that all passenger carriages and the Sentinel car, be

# THE RAILWAY CROSSING OF THE BLUE MOUNTAINS

by

R. F. Wylie (Archivist, NSWGR)

and

C. C. Singleton (Railway historian)

A series of papers published in the Bulletin of the Australian Railway Historical Society.

|                             |        |                 |          |
|-----------------------------|--------|-----------------|----------|
| Crossing the Blue Mountains | No 232 | Feb 1957        | pp 27-29 |
| Blaxland to Faulconbridge   | 236    | June 1957       | 81-90    |
| Faulconbridge to Bullaburra | 241    | Nov 1957        | 161-172  |
| Bullaburra to Katoomba      | 245    | Mar 1958        | 38-47    |
| Katoomba to Blackheath      | 246    | Apr 1958        | 49-54    |
| Blackheath to Bell          | 248    | June 1958       | 85-94    |
| Bell to Zig Zag             | 252    | Oct 1958        | 149-154  |
|                             |        | (copy attached) |          |
|                             | 253    | Nov 1958        | 165-177  |
| Langow                      | 257    | Mar 1959        | 33-47    |

had in her possession the silver spade presented to Governor Bowen on the occasion of his turning the first sod of the Queensland Great Northern (now Central) Railway at Rockhampton in 1865. This spade is now in the possession of the Association and was kindly lent to the Queensland Division for the night of the division's meeting in February last.

The spade is of sterling silver and was made in Melbourne. An idea of the intricate craftsmanship can be gained from the accom-

## THE BURNLEY ACCIDENT

(Bn. No. 246 - p. 60)

Mr. W.A. Shepherd writes:-

Mr. Gavan Duffy's enlightening and detailed article on the Burnley smash of 1882 was very interesting to read. I hardly dare question the authenticity of the author's painstaking research but is it not the case that the optimum side for a train to run is 33.33 miles in 24 minutes from start to pass, and, as is reported, between Cammerwell and Hawthorn, the distance is actually two miles beyond, if the three-quarter mile from Cammerwell to Auburn was run in 45 minutes, the train would have to be doing 60 m.p.h. The 14 miles from Auburn to Hawthorn would have to be covered in one minute, at an average speed of 140 m.p.h. to make a sharp curve at 75 miles per hour. This is an amazing speed for a suburban train in those days.

Mr. C.D. Gavan Duffy replies:-

Regarding Mr. Shepherd's remarks, there is no doubt that the figures he quotes are grossly misstated and purely rapid; I tried to make it clear that the figures which he quoted, they are, however, that was what I thought, they are, however, the figures which the Board had before I, and they did not utterly reject them, though they did reject nearly all the rest of the evidence. Probably what happened was that the guard's times were wrong and there may not have been any record at Camberwell at all and if there was, it would not be worth much. That train must have given the gatekeepers a bit of hurry-up - after leaving Camberwell there were seven of them before reaching Hawthorn. What a pity Mr. C.J. Allen was not on the train. Perhaps I could have persuaded Mr. Brownbill to put on a test run, though there are no level crossings now.

THE AUSTRALIAN RAILWAY HISTORICAL SOCIETY

**RAILWAY HIST.**  
**(Founded 1933)**

**AFFILIATIONS:** The Royal Australian Historical Society, The New Zealand Railway and Locomotive Society, The Australian Electric Traction Association, The Railway Correspondence and Travel Society (England).

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**AUSTRALIAN  
RAILWAY  
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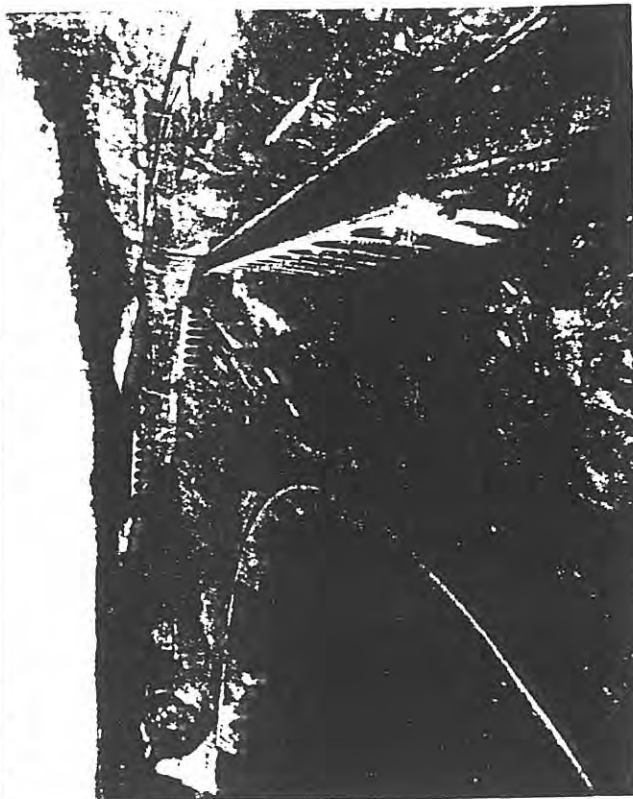
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An early photograph of the Great Zig-Zag at Lithgow, taken from the Western side, showing the three stone viaducts and the top, middle and bottom roads. (Photo: Tyrrell's Ltd)

## THE RAILWAY CROSSING OF THE BLUE MOUNTAINS

(by R.F. Wyllie and C.C. Singleton)

3. Bell to Zig - Zag

Whitton instituted a number of exploratory surveys of possible sites for Western descents of the Blue Mountains. He was prolonged, however, by the spectre of insufficient funds for the high standard he desired on the main road. He, therefore, concentrated on schemes to use the Lithgow Valley and, also, pressed by the importance of pushing on to Ballhurst in time to defeat the rival scheme of a horse-drawn tramway, laid



as a 500' wide water tunnel. The water portion he had followed so carefully and came to the conclusion that the Zig-Zag was the only practical answer.

The estimated cost of £170,000, against the £400,000 necessary for a proposed two-mile tunnel alternative route, supported his decision, while no contractor could be found who would be prepared to undertake a work of such magnitude as the tunnel at the time, nor could the estimated demolition bricks be delivered handy to the site. Four years was the earliest expected date for the tunnel completion, so that John Whitton was justified in his decision on this point alone. For, at the end of that four-year period, the line would have been open only as far as Downfields whereas, in that time, he had reached Redfern, within convenient range of Bathurst and the saving in cost paid for the 15-mile section west of Sydney.

#### Connectors

The contract of William Watkins for the earthworks, structures and permanent way from Blackheath to a spot a half-mile west of Clarence Tunnel was confirmed on the 19th January 1905, and included the tunnel at Clarence, which is 1017' in length on a grade of 1 in 60 for simple track and lined with sandstone set in cement.

West of the point where Watkins' contract left off, Mr. E. Hopkins, in May 1906, accepted the largest and most difficult contract yet faced in Australia at that time. This 15-mile section through to Wallerawang included the Zig-Zag, six stone viaducts and three tunnels through sandstone, in addition to abnormally heavy rock excavation.

The section from Mount Victoria to Lowfields was opened for traffic without any public ceremony on the 11th October 1864.

#### The Original Location

Leaving the site of the future Bell station, where Bell's line of road came in from Kurrumbidgee, the line veered to the north-west, following the key ridge where it headed the courses of Kangaroo Creek and Monkey Creek and ascended at 1 in 100 for two miles. It then descended for a mile and a half, emptying onto the beach-covered side of the Burragins Creek valley, where the watercourse could be seen in its narrow slot, some 60 feet below.

At the foot of the grade, the line turned west and crossed the creek, which was here of normal appearance - only the second watercourse traversed since leaving Lapsstone Hill. The steep ascent of 1 in 33 for 1½ miles then commenced to the site of the future Clarence Station, where the maximum altitude on the Western line was attained at 3650', just before entering Clarence Tunnel.

Here, the descent into the Lithgow Valley commenced to a point 650' below and, at

the western portal of the tunnel, the grade steepened to 1 in 42, which continued for the next 4½ miles. By means of two reverse curves, the line traversed the narrow ridge between the Zig-Zag Valley and that of leedly Creek, almost encircling Mount Sinai's dome, then continued down the western side of the Zig-Zag Valley, which here rapidly deepened, negotiated a cross-ravine by reverse 10-chain radius curves to the site where the old Edgecombe Loop was constructed in 1902, almost immediately above Bottom Points, which were in the depths of the gorge, some 200' below.

#### The Zig-Zag

As the limits of the Zig-Zag are not defined, we have arbitrarily assumed them to be from Edgecombe Loop to Cornestown level crossing, near the Lithgow loco yard, for the purpose of this article.

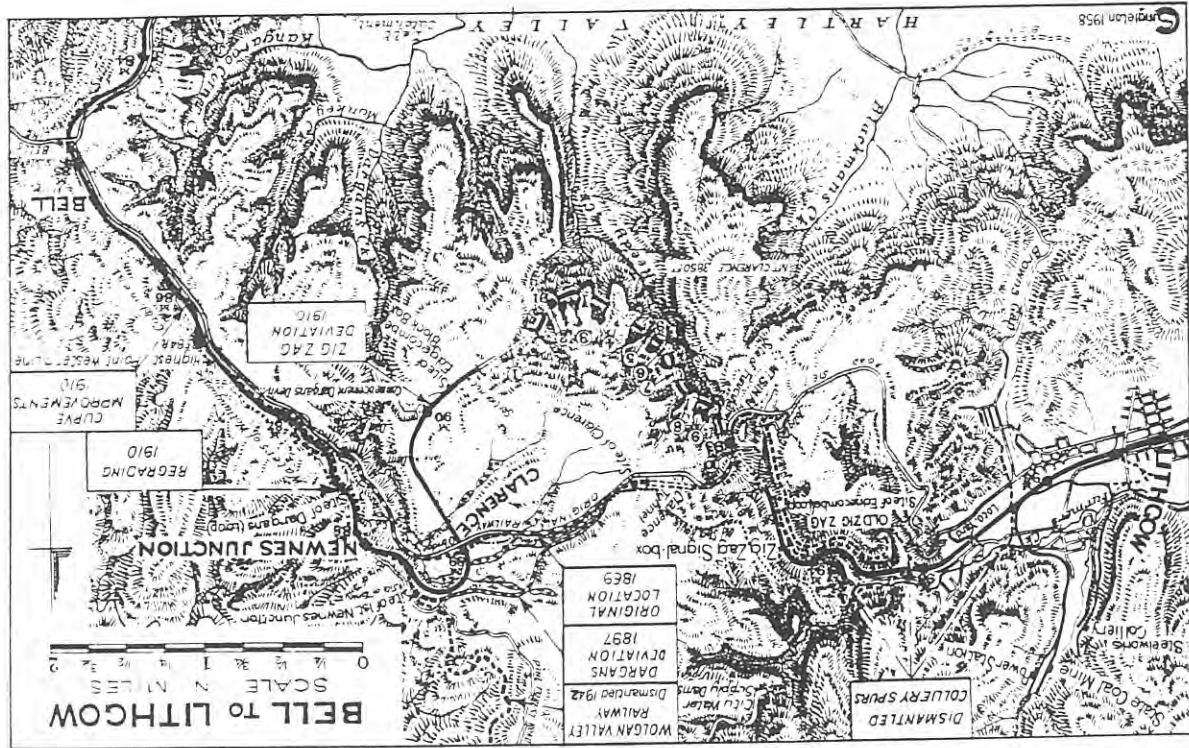
Turning west by means of an eight-chains radius curve, the line then entered that striking amphitheatre on which is displayed the major part of the Zig-Zag, with its three railway terraces, beautiful stone arch viaducts and man-made cliffs. The bottom road still remains in use by trains but the Top and Middle Roads were abandoned in 1910 but can now be negotiated by car and form a noted tourist attraction.

A ten-chain curve led onto the No. 1 viaduct, which has five 30' diameter stone arches with two 15' approach arches, crossing a ravine. The line then entered a gallery cut out of the rock and this continued to Top Points, where a buffer stop marked the end of the Top Wing, overlooking the sheer drop into Ida Falls Gully.

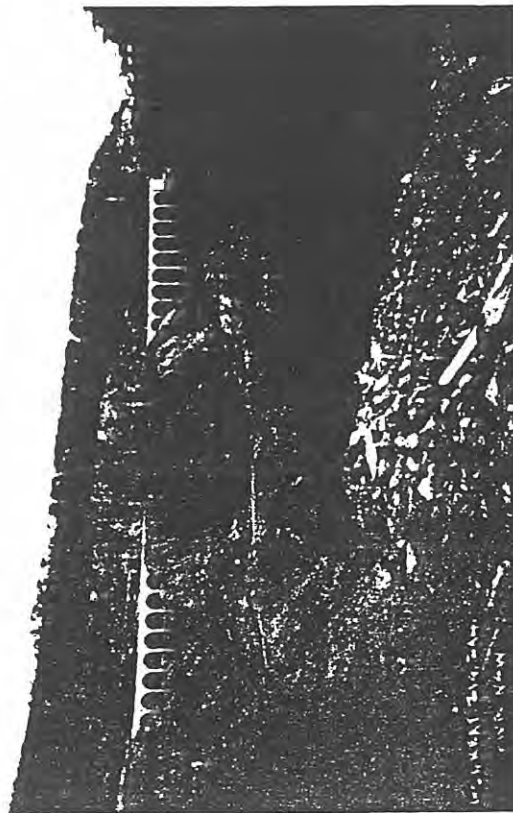
From the junction of Top and Middle Roads, the line ascended at 1 in 66, a very necessary precaution before the era of continuous brakes. Near the dead-end, the Top Wing crossed a small crevasse by a single stone arch.

The Middle Road was of chains in length between points, falling at 1 in 42 in the reverse direction, to lose 101' in altitude.

As most of the mountainside was too steep to support filling, all formation had to be in cutting or on viaduct, excavation being tipped to spoil. Nos. 2 and 3 viaducts were supported on a continuous ledge cut out of rock, which was also squared off behind the structures. No. 2 viaduct is of nine 30' and two 15' arches, the highest 75', the structure being on the straight. No. 3 viaduct is on a ten-chain curve and has eight 30' arches. A great blast, dislodging 40,000 tons of rock, was fired in January 1867, to excavate the side cut between these two viaducts. This was the first blasting operation in the Colony to use an electrical firing device and 3½ tons of blasting powder were used.







Looking towards the middle road of the Zig-Zag from the first eight-chain curve on the bottom road in the early days of its operation. In between the two magnificent stone viaducts was the site of the first electrically-fired blasting operation in the then Colony, in January 1867, when 40,000 tons of rock were dislodged. (Photo: Tyrrell's Ltd.)

Reversing to an eight-chain curve, a stone-lined tunnel, 225' in length, passes through the end of a spur. A second tunnel, 140' long, was then rammed out, after breaking through, was opened out, one of the electrically-fired explosion of 32 tons of blasting powder making 32,000 tons of rock. This blast was fired by the courtesy of Belmont, in the presence of His Excellency the Governor and a large concourse of spectators. This cut is 135' on its high side. The Middle Road ran up the gully, which was much restricted, and joined the bottom road, to run alongside the creek up the gully at 1 to 60 rising to the dead-end.

The bottom road proceeded down the valley at a lower level, turning on an eight-chain curve through a deep cutting below the Middle Road tunnel, then round the amphitheatre by a tree-chain curve, to finally enter Farmer's Creek Valley by the last of the eight-chain curves on the line. The steep grade ran out as the line reached the comparatively level floor of the valley, at the base of the spur which now carries the tourist road. The inspecting engineer for

the Railway Department, at the time, was William B. Hill.

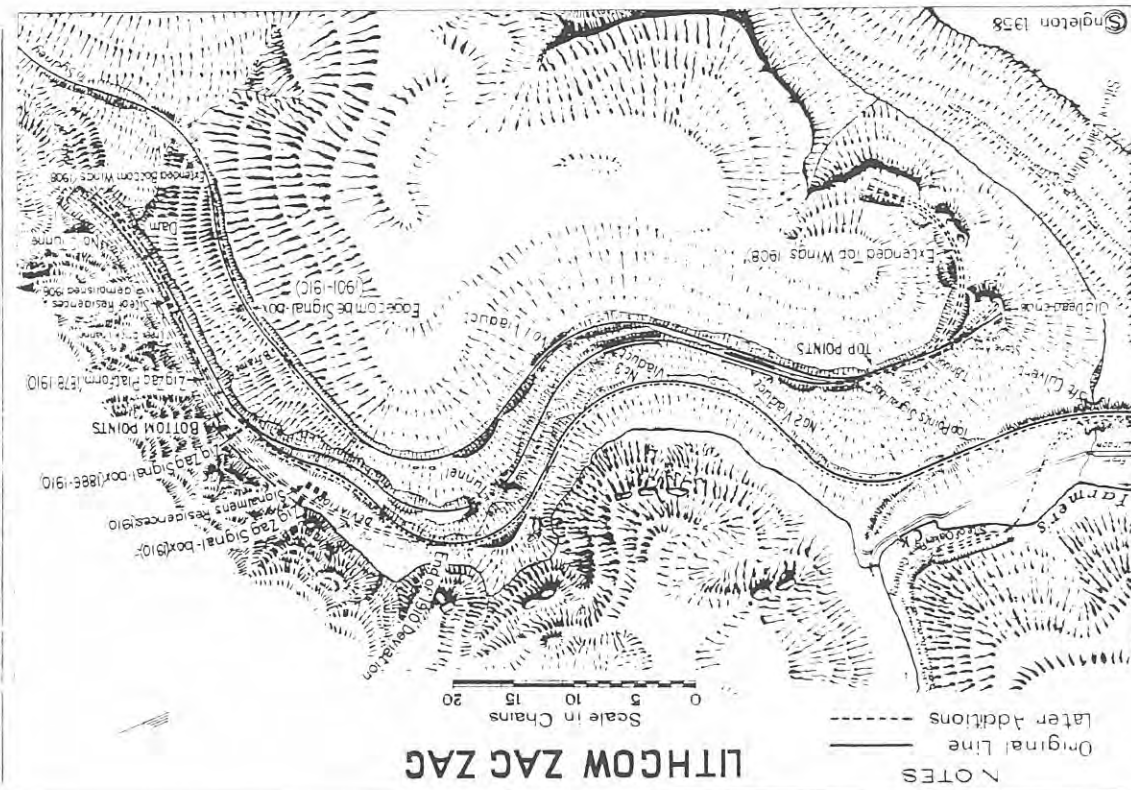
From the commencement of Higgins' contract, the line descended 500' in 1½ miles, as the crow flies, but it actually took 3½ miles to secure the 1 in 42 grade.

Visitors to Top Points should note that the original dead-end is to the right, on the cliff edge, the long curve ending in a cutting into the mountainside having been built in 1900.

#### Dagons Creek Deviation

On the 11th April 1897, a deviation was opened between Bell and Laurence, in order to eliminate the steep grades of 1 in 33 against down trains and 1 in 50 against up trains while negotiating the Dargans Creek crossing.

The new location left the original line at present-day mileage 80m, 70c, and proceeded alongside on the down side until the locations differed sufficiently to pass over the original line by means of a steel under-bridge, of which the abutments remained visible for many years after its abandonment in 1910.



Using earth-bank curves, the deviation passed to the east of the bare hill overlooking the present Newnes Junction and, turning more to the west, kept above Dargans Creek without crossing it, providing ruling grades of 1 in 40 and 1 in 70 against down and up trains respectively. It rejoined the original line in Clarence yard, the platform having to be demolished for this work.

It was superseded by the Zig-Zag Deviation and Newnes Junction regrading of 1910.

#### The Zig-Zag Deviation

The deviation to avoid the Lathrop Zig-Zag was an outstanding engineering achievement, amongst other heavy railway construction projects in New South Wales. The increasing traffic on the Western Line, as the country became developed inland, was hampered in its movement to the seaboard by the awkward reversing stations and long, in point of time, single-line sections. Ultimately, the Zig-Zag became the West's most serious bottleneck.

As far back as 1895, the numerous short trains of the period were building up delays at this point and there was much discussion between the authorities, many schemes from both Departmental and private sources receiving investigation.

Increase of train-loads, with the grade improvements and provision of engines of greater hauling power under the fully regime, gave a certain amount of relief by reducing the number of trains but the limited capacity of the top and bottom Wings of the Zig-Zag brought track saturation daily nearer.

On several occasions, the Public Works Committee took voluminous evidence and made inspections on various schemes, including a descent of Mount York and adjoining spurs into Hartley Vale (see Bn. No. 171 - January 1921). The Railway Commissioners' schemes included one with a double-road tunnel, 10,526, in length, with a continuous 1 in 50 grade against up trains and it is very fortunate that this particular scheme was not adopted.

The Public Works Committee fully justified its existence by recommending the scheme of Thomas Kennedy of the Public Works Department and Chief Surveyor of Railway Construction - a descendant of Sergeant Kennedy of the Grose River surveys fame. It was a long-sighted scheme and nothing has since occurred to question his judgment in his choice of route and grade. Its length was 5m, 6m, 52 chains shorter than the original line, and it gave a ruling grade against up trains of 1 in 40, with 14-chain curves, as against the old route with its 1 in 42 and eight-chain curves.

The new centre line left the Dargans (Creek Deviation at the present site of

Newnes Junction, running parallel but descending to cross Dargans Creek and following the curve to a semi-circle to follow the creek downstream on its opposite side for a mile, practically parallel to the original line. It then turned South-west through No. 1 tunnel to join the side of the gorge carrying Reedy Creek, which it then followed upstream through nine tunnels, reduced to eight during construction, piercing the steep rock promontories separating the deep and narrow ravines. It then entered No. 10 tunnel, piercing the narrow Mount Sinai ridge carrying the original line, to emerge into the Zig-Zag Gully, close to the dead end of the Bottom Wings of the Zig-Zag.

Owing to the persistence of Tom Johnson, the newly-appointed Railway Commissioner, the Public Works Committee finally recommended the scheme to be proceeded with, vide Act No. 36, 1906; and for double line, on the 10th December 1906, the Railway Commissioner to be the constructing authority. The Engineer-in-Chief for Existing Lines was put in charge of the colossal work and Mr. W.J. Quodling was transferred from the Public Works Department to be Resident Engineer. An organisation of 12,000 men on day labour was set up and controlled from the Resident Engineer's office in the brick residence, erected near the Clarence tunnel and still to be seen today.

#### Extension of Top and Bottom Wings

The much threatened track saturation had now come to pass and been aggravated to such an extent that trains had to be routed from the West to Sydney, via the Blayney-Bardon Line and Goulburn.

As it would take another two years, at least, before the deviation could be complete, a decision was made to extend the wings of the Zig-Zag, to enable full-length trains to be handled without dividing them into two sections. It was a huge expense for such a short period but there was no other way out of the impasse and authority was given in December 1907.

At Bottom Points, there were no serious difficulties to overcome but, at Top Points, the original dead-end was right on the cliff edge. The extension was, therefore, carried out by means of an entirely new Top Wing on a seven-chain curve, which was checked, and ended in a deep rock cutting in- to the mountainside after passing over an embankment, 60' deep and spilling sideways down some 100'. There were 70,000 cubic yards of rock excavation in this 22 chains of double line.

The work was rushed through and opened on the 17th May 1908 when, for the first time, trains could cross at Top Points and the division of trains ceased.

(To be continued)

#### Blackheath to Ball - (Bn. No. 248)

Mr. T. S. H. Miller, Managing Director of Hartley-Brightburn Coal Limited, writes:-

I enclose cheque for £1,10.0 being subscription to your Society. I congratulate you on the information collected re Hartley Vale station and goods yard but, if you have a small corner for correction, we would be glad if you would amend the name of 'Hartley Brightbird Limited' to that of 'Hartley Brightburn Coal Limited', as this is the name which has been registered for a number of years.

My family has been connected with Hartley Vale for over 100 years, my grandfather, Peter Miller, having claim on the land, formed a kerosene company as he was a director of the Australian Gas Light Company and wanted shale to fortify the illuminating qualities of the gas.

#### MYENSA

(by M.C.G. Schröder)

"Myensa" - the letters standing for Mid-Year Excursion in the Northern Suburban Area - was the name adopted for the Victorian Division's tour by special train on Saturday, 31st May last. Destinations were the suburban terminus of Thomastown and Hurstbridge, via the "Inner Circle" line, now used for goods traffic only.

The train consisted of four H-class open saloon cars, with No. 1 HCPM, as a van at one end and No. 3 ABC at the other.

03-613 was at the head of the train as it left Flinders Street Station, two minutes late, at 12.04 p.m., proceeding via Spencer Street to Royal Park, thence over the "Inner Circle" through the abandoned stations of North Carlton and North Fitzroy to Northcote.

Loop Junction. Progress along the Whittlesea line to reservoir was somewhat slow and we arrived at Thomastown, two minutes late, at 1.37 p.m.

After the 03 had run round, we retraced our steps to Northcote Loop Junction and in to Clifton Hill. Here, the 03 was detached and 3-520, tender first, was attached at the other end of the train. Two engines were necessary owing to the lack of working facilities and they added to the variety. As a result of late crossings on this largely single track our arrival at Hurstbridge was six minutes late.

Departing at 4.42 p.m., a pleasant run brought us to Flinders Street at 6.10 p.m., a most enjoyable afternoon.

(Vic.)

#### THE 3' 6" - GAUGE PASSENGER ROLLING STOCK OF THE SOUTH AUSTRALIAN RAILWAYS (S.A.)

(by D.B. Parsons)

(Continued from Bn. No. 251 - p. 147)

#### 2 - 50' Cars - 5' 3" - Gauge Cars Nos. 488 to 494 (Continued)

As detailed previously in the 300 and 400-class cars, No. 490 was recovered to 3' 6" gauge during 1945 and resumed its original number, 107, while No. 495 was converted to Baby Health Car No. 1 during 1952. Prior to conversion, No. 252 had been used as a temporary dining car during 1920 on the Royal Train.

Although all the broad-gauge cars had bodies with longitudinal seats when converted, this is not so at present, while some have had other bodies for varying periods.

No. 494 exchanged bodies with No. 190 (3' 6" gauge) during 1942 and ran with this semi-corridor body until 1945, when bodies were re-exchanged, so that No. 494 now has its original body.

No. 493 similarly ran with the semi-corridor type body of No. 219 (3' 6" gauge) from 1942 to 1945 but then exchanged bodies with No. 107 (3' 6" gauge), this latter body having longitudinal seats. No. 490 exchanged bodies with No. 212 during 1942 and is still running with this body, which is of

## CONTEMPORARY REFERENCES

1872-3.

LEGISLATIVE ASSEMBLY.  
NEW SOUTH WALES.

# REPORT

ON THE

CONSTRUCTION AND PROGRESS

OF THE

## RAILWAYS OF NEW SOUTH WALES,

FROM 1866 TO 1871 INCLUSIVE.

BY

JOHN RAE, M.A., COMMISSIONER FOR RAILWAYS.

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ORDERED BY THE LEGISLATIVE ASSEMBLY TO BE PRINTED,  
21 April, 1873.

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quantities of excavation on the different lines, at 31st December 1871 (omitting the rock in live contracts), were as under:

|                | Miles open. | Excavation.  | Proportion of Rock. |
|----------------|-------------|--------------|---------------------|
|                |             | cubic yards. | cubic yard.         |
| Southern ..... | 81          | 2,001,368    | 516,501             |
| Western .....  | 77          | 5,021,518    | 1,782,833           |
| Northern ..... | 57          | 2,009,017    | 189,563             |
| Total .....    | 215         | 9,124,933    | 2,518,897           |

Thus, according to the mileage, there was more excavation but much less rock on the Northern than on the Southern; while on the Western there were more excavation and much more rock than on the Southern and Northern lines combined.

The steepest gradients are 1 in 30 on the Southern and Western, and 1 in 33 on the Northern; and the smallest radius of a curve is 16 chains on the Southern, 8 on the Western, and 20 on the Northern extensions.

At Picton, 53 miles from Sydney, where the Southern extension commences, the line is 519 feet above high-water mark; and at 91 miles from Sydney, near Mr. Badgery's residence, it reaches the highest elevation of 2,357 feet, thus rising 1,808 feet in a distance of 38 miles.

The Western line at Penrith, 34 miles from Sydney, is 88 feet above high-water mark, and attains its highest level of 3,658 feet, at the entrance to the Clarence Tunnel, 58 miles from Sydney, thus ascending 3,570 feet in 54 miles.

The Northern extension, starting from Singleton, 19 miles distant from Newcastle, at an elevation of 135 feet above high-water mark at that port, ascends to 1,516 feet at Murrumbidgee, 120 miles from Newcastle, rising 1,111 feet in 71 miles.

The principal objects of interest on these extensions are the Zig-zags at Lithgow Valley, on the Western. Since the opening of the line to Bowenfels, thousands of tourists from all lands have visited these works, and expressed unbounded admiration at the rugged grandeur of the scenery, and the engineering skill and pluck displayed in designing and constructing these stupendous works, which are probably not surpassed on any Railway in the World.

But a description or even an inspection of the Lithgow Valley Zig-zag, gives but an imperfect idea of the difficulties that had to be encountered, and the vast amount of work that had to be performed, before it was hewed into its present shape. From the Clarence Tunnel to the bottom of the valley there is a descent of 170 feet, through a deep and rugged ravine, where formerly there was scarcely footing for the mountain goat, and where the surveyor's assistants had occasionally to be suspended by ropes in the performance of their perilous duties. But human skill and enterprise have opened a pathway through these broken mountain ranges for the railway train, that now traverses the sides of the mountains, on a gradient of 1 in 12.

In the execution of these works, two gigantic masses of rock—the one estimated to contain 40,000, and the other 15,000 tons—had to be blasted; and the contractor, after estimating the cost, determined to call in the aid of electricity for the purpose. The first mass to be operated upon was a spur of the mountain, a few hundred feet from the first reversing station, which blocked up a portion of what is now the middle line of railway. Preparations were accordingly commenced, by excavating a trench on the top of the rock, in the line where the division was required to take place, and drilling in this trench twenty-five triangular holes, 30 feet deep, and of sufficient capacity to be charged with  $3\frac{1}{2}$  tons of blasting powder, in all. The pyramidal arrangements were made under

The Zig-zag on Western line—objects of interest.

Magnitude of works on Zig-zag, Lithgow Valley.

Blowing of gigantic mass of rock by electricity.



the directions of Mr. Cracknell, Superintendent of Telegraphs, who, on the 5th January 1867, succeeded in firing the blast, which tore the mountain asunder, heaving huge masses of rock into the valley, and leaving the face of the parent mountain almost as plain as if it had been cut with chisels.

Blowing up of  
tunnel by  
electricity.

On 16th September 1868, another electric shock was employed in blowing up a tunnel, which perforated the mountain about 200 yards from the second reversing station. After the boring of this tunnel had been completed, the Engineer-in-Chief, from careful inspection, entertained doubts of its stability, and gave orders for its removal. This was successfully accomplished in the same manner as the last, by means of the galvanic current acting on 3½ tons of powder, in chambers cut in the rock for its reception. The battery operations were again conducted by Mr. Cracknell, and the electric spark was communicated to the powder by the hand of the Countess of Belmore, in the presence of His Excellency the Governor and a large concourse of spectators, who had assembled to witness the effects of the explosion.

Blasting of  
80,000 tons of  
rock in two  
shots.

Appendix 2.

A feat so startling, by which in two blasts upwards of 80,000 tons of rock were torn from the solid mass and shattered to pieces, is worthy of record in a description of our railway works; and I have appended a full account of the whole proceedings, from the pages of the *Sydney Morning Herald* of 7th January 1867, and 18th September 1868.

Cost of  
construction,  
Appendix 17.

Cost of lines  
open for traffic.

In Table No. 17 of the Appendix will be found a detailed statement of the cost of construction of our Railways, and the total expenditure, including rolling stock, machinery, workshops, station and other buildings, and trial surveys, from the commencement to the 31st December 1871. The cost of lines open for traffic at any period cannot be exactly stated, but may be ascertained sufficiently near the truth by deducting the amounts paid to contractors during the year from the total cost. This will give the following results:—

| Year. | Lines open for Traffic. |    |    | Lines in Progress. |    |    | Total Expenditure. |    |    |
|-------|-------------------------|----|----|--------------------|----|----|--------------------|----|----|
|       | £                       | s. | d. | £                  | s. | d. | £                  | s. | d. |
| 1865  | 2,746,373               | 5  | 5  | 869,622            | 11 | 4  | 3,615,995          | 16 | 9  |
| 1866  | 2,786,094               | 10 | 7  | 1,321,885          | 9  | 8  | 4,107,980          | 0  | 3  |
| 1867  | 3,282,319               | 18 | 4  | 1,377,196          | 6  | 1  | 4,659,516          | 4  | 5  |
| 1868  | 4,060,950               | 2  | 5  | 1,159,217          | 5  | 0  | 5,220,167          | 7  | 5  |
| 1869  | 4,681,329               | 7  | 6  | 985,634            | 17 | 7  | 5,666,964          | 5  | 1  |
| 1870  | 5,566,092               | 9  | 5  | 607,566            | 10 | 3  | 6,173,658          | 19 | 8  |
| 1871  | 5,887,257               | 14 | 3  | 632,025            | 17 | 10 | 6,519,283          | 12 | 1  |

Cost per mile.

From this statement, it will be found that the cost per mile, on the average length of the lines open for traffic, was as under:—

| Year. | Lines open for Traffic. |       | Average length of Line open. | Cost per Mile. |
|-------|-------------------------|-------|------------------------------|----------------|
|       | £                       | miles |                              |                |
| 1865  | 2,746,373               | 143   |                              | 19,205         |
| 1866  | 2,786,094               | 143   |                              | 19,483         |
| 1867  | 3,282,320               | 175   |                              | 18,756         |
| 1868  | 4,060,950               | 225   |                              | 18,048         |
| 1869  | 4,681,329               | 269   |                              | 17,402         |
| 1870  | 5,566,092               | 329   |                              | 16,918         |
| 1871  | 5,887,258               | 350   |                              | 16,820         |

Reduction in  
cost per mile  
occasioned by  
cheaper  
extensions.

The reduction in the cost per mile, from 1866 to 1871, is attributable to the reduced cost of the works on the extensions. The cost of the double line from Sydney to Parramatta, which was at the rate of £14,321 per mile in 1861, is gradually reduced as it

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## APPENDIX

TO THE

REPORT ON THE RAILWAYS OF NEW SOUTH WALES,

FROM 1866 TO 1871 INCLUSIVE.

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## No. 1—continued.

## Section No. 3.—Length, 15 miles 34 chains.

This contract was let to Mr. W. Watkins on the 14th August, 1863, and completed in August, 1866. Eighty-one culverts have been constructed, of an aggregate length of 2,837 feet, and consist of—

|                  |                 |
|------------------|-----------------|
| Nineteen.....    | 1 foot 6 inches |
| Sixty-eight..... | 2 feet          |
| Two.....         | 3 "             |
| Two.....         | 8 "             |

The total quantity of excavation is 421,801 cubic yards, 229,637 cubic yards being rock.

The total cost of the works, exclusive of rails, sleepers, ballast and road laying, has been £61,390 15s. 1d.

The steepest gradient is 1 in 33 for a length of 1 mile and 66 chains, and the smallest radius of a curve is 8 chains.

The level of rails at the commencement of this contract, near to the Blue Mountain Inn, is 2,403 feet, and the level of rails at the termination of the contract is 3,494 feet above high-water of spring-tides at Sydney.

## Laying and ballasting permanent-way.

On the 17th October, 1865, a contract was entered into with Messrs. Larkin and Wakeford for laying the permanent-way, including the providing of sleepers and ballast for that portion of this extension between Penrith and Blackheath, being a length of 38 miles 8 chains.

This work has been satisfactorily completed. The total cost, exclusive of rails and other ironwork for permanent-way, but including sidings, and a temporary station at the Weatherboard, and the sidings at the Blue Mountain, has been £78,725 13s. 10d.

## Section No. 4.—Length, 15 miles 76 chains 35 links.

This contract included the ballasting and laying of the permanent-way, in addition to the usual works, and was let to Mr. W. Watkins on the 19th January, 1865. The whole of the works have been satisfactorily completed.

The tunnel through Mount Clarence is 533 yards in length, and lined with masonry, set in cement throughout.

Seventy-four culverts have been constructed, of an aggregate length of 3,149 feet, and consist of—

|                 |         |
|-----------------|---------|
| Two.....        | 1 foot. |
| Sixty-five..... | 2 feet. |
| Five.....       | 3 "     |
| One.....        | 5 "     |
| One.....        | 10 "    |

The total quantity of excavation is 594,553 cubic yards, 421,697 cubic yards being rock.

The total cost of this section, including all works, laying the permanent-way, providing sleepers and ballasting, but exclusive of rails, chairs, &c., and stations, was £187,734 15s. 10d.

The steepest gradient is 1 in 33 for a length of 1 mile and 31 chains, and the smallest radius of a curve is 10 chains.

On this contract, at the entrance to the Clarence Tunnel, a distance of 884 miles from Sydney, the Railway attains its highest level between Sydney and Bathurst, the rails being 3,658 feet above high-water of spring-tides at Sydney.

## Section No. 5.—Length, 15 miles 10 chains 65 links.

This contract included the ballasting and laying of the permanent-way, in addition to the usual works, and was let to Mr. P. Higgins in May, 1866.

The whole of the works have been satisfactorily completed.

On this section there are seven viaducts and two bridges over the Railway, of an aggregate length of 2,225 feet, varying in height from 10 feet to 70 feet, and consist of the following spans:—

|                                  |  |
|----------------------------------|--|
| Four openings, each 10 feet span |  |
| Two " " 15 "                     |  |
| Three " " 20 "                   |  |
| Fourteen " " 25 "                |  |
| Two " " 27 "                     |  |
| Thirty-seven " " 30 "            |  |
| One " " 54 "                     |  |

One timber approach bridge, eight openings, each of 25 feet.

There are also three tunnels: one on the Lithgow Valley Zig Zag, 77 yards in length; one at Morangaroo, 267 yards in length; and one under the Mulgee Road, 47 yards in length.

The total quantity of excavation is 1,144,284 cubic yards, 747,710 cubic yards being rock.

The total amount paid for all works on this contract, including fencing, ballasting, sleepers, and laying permanent-way sidings at Bowenfollie, Wallerawang, and water supply at Lithgow Zig Zag, but exclusive of station buildings, rails and other ironwork for permanent-way, has been £323,284 10s. 9d.

The steepest gradient is 1 in 40 for a length of 2 miles, and the smallest radius of a curve is 8 chains.

## Section No. 6.—Length, 6 miles 6 chains.

This contract was let to Mr. Mackenzie on the 29th June, 1867; but he having abandoned the works in the beginning of 1868, the contract was relet to Mr. McCauley on the 27th April, 1868, and the works have been satisfactorily completed by himself and Mr. Forrester (one of his sureties).

The total quantity of excavation is 233,239 cubic yards.

Twenty-two culverts have been constructed, of an aggregate length of 1,661 feet, and consist of—

|   |        |
|---|--------|
| One double open culvert, 1 foot 10 inches |        |
| Four.....                                 | 2 feet |
| Ten.....                                  | 3 "    |
| Three.....                                | 5 "    |
| Four.....                                 | 6 "    |

The total cost, including the sidings at Rydal, fencing, clearing, ballasting, sleepers, and road-laying, but exclusive of rails, chairs, &c., has been £18,910 1s. 9d.

The steepest gradient is 1 in 50 for a length of 1 mile 14 chains, and the smallest radius of a curve is 20 chains.

## Section No. 7.—Length, 16 miles and 66 chains.

This section, which commences at Rydal, was let to Mr. D. Williams on 14th August, 1868, the time for completion being 31st December, 1870, which has since been extended to 31st January, 1872. With the exception of the laying of 7 miles of the permanent-way, this contract is very nearly completed.

The total quantity of excavation removed up to 31st December, 1871, including excavation to foundations of bridges and culverts, was 945,669 cubic yards.

There are the following bridges over Solitary Creek, varying in water-way from 30 feet to 120 feet, viz.:—

| No.          | Miles, Chains. | One | 30-feet span, built in brickwork. |
|--------------|----------------|-----|-----------------------------------|
| 1, at 111 49 |                | 30  | " "                               |
| 2, " 111 58  |                | 30  | " "                               |
| 3, " 111 73  |                | 30  | " "                               |



## No. 2.

EXTRACT from *Sydney Morning Herald*, 7 January, 1867.

## GREAT BLASTING EXPLOSION ON THE WESTERN RAILWAY.

"Those who are accustomed to travel over that portion of this Colony lying between Penrith and Bathurst need not be informed of the great engineering difficulties to be encountered in the construction of a line of railway through that mountainous part of the country, as these difficulties are apparent to every one—not only to those who frequently travel to the west, but to the casual visitor. There is scarcely a level piece of ground from the rise of Lapstone Hill to the end of the line so far as it has been surveyed. From the point just mentioned to the end of No. 5 Contract (embracing the whole of the line beyond Penrith, either constructed or in course of construction) it is one series of cuttings, embankments, viaducts, bridges, tunnels, and steep ascents and descents; but great as are the difficulties along the line, an example of each is to be found in the deep ravine known as the descent into Lithgow's Valley, and in order to convey a better idea of the explosion which took place on Saturday last, it will be necessary to give a brief outline of the plan, and of the country, by which the line descends to that point where the explosion took place. From the western opening of the Clarence tunnel to Bolton's public-house, situated in the valley, and less in distance than a mile and a half as the crow flies, there is a descent of no less than 470 feet. This fall in the line is effected by a gradual descent of 1 in 42, the line being carried around a mountain from the Clarence tunnel down to the head of the ravine before mentioned. This deep ravine or valley, lying between two high and rugged mountains, the sides of which in some places are perpendicular, is irregular in direction, and hence there will be some very sharp curves in that part of the line, some of them only eight chains radius. The irregular nature of the side of the ravine on which that part of the line known as the Zigzag is being constructed, also renders necessary the construction of a number of cuttings, several large embankments, five viaducts, and two tunnels. On reaching the head of the ravine the line is carried across to what we shall term the south side of the valley or ravine, by means of an enormous embankment, from which it will descend in a curve, round the side, through several cuttings and two large viaducts, the construction of which has just been commenced. These viaducts will be on the edge of the cliff overlooking the valley, but no adequate idea of the difficulty of erecting, staging, and constructing the masonry works could be given short of a personal inspection of the ground. From the second viaduct the line continues to descend in the same proportion—1 in 42—through several cuttings in the solid rock, to the first reversing station, which will be situated on the very brink of the precipice,—and it would not surprise us if travellers were a little nervous at travelling over this portion of the line for the first time. Every possible precaution is being taken in the construction of the line to ensure safety; but the traveller would not be able at first to direct his mind from the idea that any accident could precipitate the train and its living freight in thundering violence to the valley several hundred feet below. On reaching the first reversing station, the line is brought, as it were, to a stop, and, forming an acute angle, it descends along the edge of the precipice, by means of heavy cuttings through the rock, and several viaducts, to a spur in the mountain, through which a tunnel seventy-five yards in length has already been constructed. Emerging from this tunnel, the line is carried over another viaduct to a second spur in the mountain, through which a tunnel of 493 yards in length is being excavated. Thence the line will pass over a large embankment, to be supported by an enormous retaining wall, and thus it will be carried back to the head of the gully, where the second reversing station will be placed. From this point the line will be carried down the side of the ravine, almost immediately underneath the middle line, will pass round the base of the spurs, tunnelled for the middle line, and be carried, by means of immense cuttings and embankments down the valley in the direction of the Mudgee Road, where, for the present, we must leave it.

"We next come to the scene of last Saturday's operations. Between two and three hundred feet from the first reversing station (which it must be remembered is on the brink of the precipice) on the middle line there stood an enormous block of stone, or spur of the mountain, which was found to contain 45,000 tons of stone, and before the middle line could be constructed this mass must be removed. Upon calculation it was found that the removal of this block by the ordinary methods of day labour and blasting would cost not less than £5,000, and this being so, it was determined to remove it by some other method. After a good deal of deliberation and many consultations it was resolved to endeavour to remove it by sinking a number of holes to a great depth on the line required for the railway, placing a large quantity of blasting powder therein, and firing it by means of an electric shock. The Government gave Mr. Cracknell permission to do all that was necessary to ensure the success of the experiment, and preparations were at once commenced. In the first instance, a ditch some six feet deep was dug across the block where the division of the projecting mass from the mountain was required, and then twenty-five holes, six inches in width, and of a uniform depth of thirty feet, were cut in this ditch. The labour of cutting these holes was very heavy, and extended over two or three weeks. Each hole was triangular in shape, one side of the triangle of each hole being parallel with the line where the division of the mass of rock from the mountain was required. The other two sides of each hole pointed towards the rock to be removed. The object of cutting these triangular holes in the way described, was to ensure the division of the rock from the mountain in the required line, and also to split up the mass to be removed into a large number of pieces, it having been found by experiment that powder in exploding generally produces fissures in a line with the corners of the hole from which the explosion takes place. In view of the economy of labour, and the necessity of keeping the side of the mountain solid for the railway, it was of the first importance that the mass of rock should be cut off as cleanly as possible, and hence the cutting of these triangular holes. The boring of circular holes would not have entailed half the labour; but had this course been taken the fracture of the rock would doubtless have been irregular, and the side of the mountain, for the construction of the line, might have been very much shattered. These holes were cut under the superintendence of Mr. Cornelle, Mr. Higgins's overseer.

The preparations having been so far completed, Mr. Cracknell arrived from Sydney with the necessary electrical apparatus for firing the blast, on Friday last, and spent nearly the whole of the day in giving instructions and making arrangements for the morrow. On Saturday morning, Mr. Cracknell and Mr. Higgins, accompanied by Mr. Hulle (the Government resident engineer), Mr. Kerr, manager for Mr. Higgins, Mr. Glover, engineer for the contractor, Mr. Cornelle and a numerous body of workmen, were at the scene of operations by 6 o'clock, and while Mr. Cracknell superintended the charging of the holes, Mr. Hulle (who is an amateur electrician as well as engineer) unpacked the apparatus and constructed the battery. Each hole was charged as follows:—Half the allotted quantity was first poured powder was poured in, and the tamping was then put in and firmly rammed down, care being taken to avoid injuring the wires. Mr. Cracknell tested the wires after each hole was filled, to insure the connection. The cartridge consisted of a small pill-box into which the two ends of the wire were placed, and these wires were connected by means of a piece of very thin platinum wire. Around this wire was placed some gun-cotton, and the box was then filled with fine powder. The quantity of blasting powder used in this explosion was three tons and a quarter. The battery was placed between one and two hundred feet from the east end of the block to be blown down, and there was of course a perfect connection between the wire stretched from the battery and those placed in the twenty-five holes. It was intended to make an earth connection with the wire at the far end, and for this purpose a hole was drilled into the rock, and some water, to insure the connection, was poured into the hole on Friday night. Everything being ready, and a large number of ladies from different parts of the district being in the immediate vicinity, by invitation, to witness the explosion, the signal was given, and at five minutes to 1 o'clock Mr. Cracknell made his first attempt to fire the blast. Every one waited in breathless anxiety, and with some misgivings in regard to their safety—for it was impossible to foresee the consequences. The first attempt failed; and Mr. Cracknell at once judged the cause of the failure to be in the imperfect earth connection. To remedy this he determined to make a wire connection; and a new wire was consequently stretched down to the far end of the block, and connected with that end of the wire. After about half an hour's delay the second attempt was made; and this failed also. This was most annoying;—every one present was exceedingly anxious that the first attempt to blast by means of electricity should succeed, and it is no wonder that some, after the failure of the second attempt, should predict a failure. Mr. Cracknell, though perhaps more anxious than any one else, was not the man to give in without a most determined effort; and knowing that the connection between the battery and the wire in the far hole was perfect, he thought that the imperfect connection must be in the return wire. A test satisfied him of the correctness of his opinion—the wire had by some means been accidentally damaged. Another wire was now stretched from the battery to the far end, and the connection completed, a test having been applied before the third attempt was made to fire the blast. In addition to the delay thus caused, Mr. Cracknell's personal safety was somewhat endangered by having (in consequence of using up so much spare wire) to fire the charge from the battery, which, we need hardly say, was far too near the rock to be comfortable for the operator. At five minutes to 2 o'clock the third



## No. 2—continued.

signal of "all ready" was given; the necessary touch was applied, and in an instant a dense mass of rock and earth flew into the air with a rumbling sound, like that of distant thunder, proving, beyond all doubt, the success of the undertaking. For a few seconds the scene of the explosion was obscured from view, but the immense pieces of rock leaping from point to point, and dashing with a thundering noise into the ravine below, told clearly enough that an immense mass of rock must have been dislodged. A close inspection afterwards showed that about one-third of the enormous projecting mass,—some at both ends and a large quantity from underneath—had come down, and the remaining or centre portion, which still stood, had been forced bodily away from the mountain, leaving a fissure of from six to ten feet wide along the line where the holes had been cut. It was observed that, in the forcing out of this immense block, a portion of the foundation on which it stood had crumbled away, and it now stood upon a narrow base indeed. It was evident that but little, however, comparatively, was necessary to topple over the remainder of the mighty mass, and Mr. Cracknell at once determined to remain until two or three other charges of powder could be put in, so that he might complete the work which he had so successfully commenced. Were it not that the non-removal of this mass of rock would retard the progress of the works it might be permitted to remain, as the operation of the atmosphere—especially of rain—would ere long undoubtedly send it over.

Shortly after the explosion had taken place, the party, numbering upwards of fifty persons, sat down to an excellent luncheon, served in No. 1 Tunnel. A better or cooler place for a luncheon, considering the intense heat of the weather, could not be conceived. Among those present were Mr. P. Higgins, the contractor for the section, in the chair, Mr. Andrew Brown, Police Magistrate of Hartley, Mr. Thomas Brown, Mr. Lucas, M.L.A., Dr. Platau, Mr. Cracknell, Mr. Morgan (associated with Mr. Watkins in No. 4 Contract), Mr. and Mrs. Barton, Mrs. Walker, Mr. Forster, Mr. Roberts, Mr. and Mrs. Hulle, Mr. and Mrs. Kerr, Mr. and Mrs. Glover, Mr. Quodling, Government Resident Engineer of No. 4 Contract, also the Manager, and Contractor's Engineer, Mr. W. Cooper, Sub-contractor for No. 1 Tunnel, Mr. Cornille, and a number of others. The operations of the morning had fully prepared the company for the luncheon; and poultry, cold joints, together with champagne, sherry, and delicious cawarra, disappeared in the most surprising manner. After discussing the excellent fare provided, the Chairman gave the usual loyal toast of 'The Queen,' which was received with all the honours. Mr. Lucas, in a few well-chosen remarks, proposed the health of Mr. Higgins, a gentleman who, he hoped, would be as successful in the whole of his contract as he had been in the explosion that day. Mr. Higgins acknowledged the compliment, and expressed his determination to carry out the work of the contract to the best of his ability. In conclusion, he proposed the health of Mr. Burton, a gentleman who deserved all the credit which attached to the undertaking of laying out this line. Mr. Burton, in responding, admitted that the laying out of this line had not been done without some labour, both physically and mentally. It was a matter of great satisfaction to him to see what he might term the work of his life being so successfully carried out. In conclusion, he congratulated Mr. Higgins and Mr. Cracknell on the success of their operations that morning.

The Chairman proposed the health of Mr. Cracknell, and in doing so spoke in complimentary terms of the scientific abilities and energies displayed by that gentleman in carrying to a successful issue the event which they had all assembled to witness. Mr. Cracknell, in acknowledging the toast, expressed the pleasure which he felt in having carried the blasting operation out successfully, and his gratification that he had been of some little service to Mr. Higgins. Mr. Lucas proposed the health of Mr. Hulle, and that gentleman returned thanks. Mr. Cracknell added his testimony to that of Mr. Lucas, of the assistance rendered to him by Mr. Hulle in conducting the operations of the morning; but for the zealous co-operation and assistance of Mr. Hulle the explosion would have been much longer delayed. The health of Mr. Lucas, as the Member for the district, was proposed, and in responding Mr. Lucas took occasion to remark the great progress made in the contract during the last three or four months; he expressed his belief that in the absence of railway communication the country would never be in a really prosperous state. The Chairman proposed 'The Landowners on No. 5 Contract,' coupling with it the name of Mr. Andrew Brown. Mr. Brown suitably acknowledged the compliment. The health of Mr. Kerr, and other toasts, followed, and the party broke up early in the afternoon.

Reserving for a future occasion any details of the works now in progress on No. 5 Contract, we may state that the line throughout the whole length of the contract is in hand. Mr. Higgins, with commendable perseverance, has put men on to work wherever their services can be made available, and the result is that the construction of the line is going on simultaneously in thirty or forty different places; he has not less than 700 men now employed, and he anticipates being able to put on a large number of additional hands so soon as the remainder of this large block of 45,000 tons of stone has been disposed of."

EXTRACT from *Sydney Morning Herald*, 18th September, 1868.

## GREAT BLASTING EXPLOSION ON THE WESTERN RAILWAY.

"THE difficulties presented to the engineer in constructing a line of railway across the rocky mountain range lying between Enns Plains and the low country in the neighbourhood of Bathurst were, with two or three exceptions, without parallel in the world; and certainly there are no railway works in either of the other Colonies where the difficulties presented could for a moment be compared with them. In the earlier days of the Colony, the construction of a railway across the Blue Mountains was thought to be an impossibility, and it was in view of the immense difficulties presented on every hand that the author of our Constitution said that bullock-drays were the proper mode of locomotion for this country. Mr. Wentworth has, however, lived to see the iron horse snorting across the gorges of the Blue Mountains, and he may yet live to see the lines opened to the metropolis of the South, and the metropolis of the West. Years were spent in surveying the country to the west of Parramatta; a practical route was at length discovered, a line was eventually laid out, and a railway to Bathurst became a possibility. Those who are accustomed to travel by the Western line so far as it is open to the public, need not be told of the immense amount of skill, labour, time, and money that were required to complete the line to Mount Vittoria, although many of the difficulties have disappeared in the actual construction of the line. There is scarcely a length of 10 chains either of straight or level line from the rise of Lapstone Hill to the crossing of the Mudgee Road, at the foot of Lithgow Valley; and for present purposes we need not go further, although there is a good deal of broken country lying between this point and Bathurst. Deep cuttings, enormous embankments, steep gradients, and sharp curves—some of them having a radius of 8 chains only—are everywhere met with; and nowhere were the difficulties to be encountered in laying out the line so great as in descending from the tunnel through Mount Clarence to the foot of Lithgow Valley. The head of this valley consists of a deep rocky gorge, and is the wildest place imaginable for the construction of a railway. In some places the line will be cut from the sides of the solid rock,—in other places it will be carried over immense viaducts of masonry, and in one place it will pass through a tunnel cut through an immense mass of jutting rock. The descent of the line from the top of the cliffs down to this deep glen will be obtained by means of a zigzag similar to that just above the viaduct over Knapsack Gully, only very much longer, the gradient in the Lithgow Valley zigzag being 1 in 42. In order to construct this portion of the line, an enormous quantity of blasting has been done, and much more requires to be done. Some twenty months ago a very large mass of projecting rock that required to be removed before the middle line of the zigzag could be constructed, was displaced by means of blasting-powder, fired by electricity, and a report of the operation appeared in this journal at the time. Some weeks ago it was found that another enormous mass of projecting rock, measuring 40,000 cubic yards, would require removal, and it was again determined to invoke the aid of powder and electricity. In the first instance, a tunnel (known as No. 2 tunnel) was cut through this rock, and shortly afterwards the engineers began to entertain doubts whether the rock would stand, as it was found to contain a large number of deep fissures, through which sand, &c., were continually running. It was also found that a large portion of this rock rested upon a bed of pipeclay and shale, which only required the inlet of water to cause the overhanging mass to slip away. Under these circumstances, to avoid the possibility of an accident to a train, Mr. Whitton, the Engineer-in-Chief for Railways, determined to have the rock removed, and he gave instructions to the contractor, Mr. Higgins, to take it down. With the permission of the Government, Mr. Cracknell, Superintendent of Telegraphs, undertook to have a powerful battery on the ground, and to fire the charges of blasting-powder which would be deposited in the rock. The removal of the whole of the block at one explosion would, of course, effect an immense saving of time, labour, and consequent expense; and Mr. Higgins and his employes commenced to make preparations for the great blast. In the first instance, they cut three chambers in the face of the rock, inside the tunnel—one 32 feet, one 27 feet, and one 22 feet—and then others at right angles, giving them the form of the capital letter T; and in these chambers, which were on a level with the

## No. 2—continued.

floor of the tunnel, were deposited two tons of powder. On the top of the rock, fifteen drives, varying from 20 to 30 feet in depth, were bored, and in these holes were deposited one ton and a half of powder. The battery by which the whole of the powder was instantaneously fired was composed of fifty-eight cells, and is known as Callan's Maynooth Battery. All the wires terminated in a box, composed of copper and zinc, which was enclosed in a small circular deal box, and deposited in the centre of each charge of powder. The wires were then attached to the two other wires that were connected with a switch, or circuit closer, placed about a hundred yards from the rock to be removed, where everything was prepared for the explosion when the proper moment should arrive.

Having written thus much of the necessity for the removal of the rock, and the mode of effecting it, we must say something of the different had persons who were present on the occasion of the explosion on Wednesday last. A special train, with the Hon. Sir John Lubbock, Mr. B. J. Lubbock, Miss Gladstone, the Hon. J. and Mrs. Martin, the Hon. J. J. Byrnes, Minister for Works, the Hon. J. R. Wilson, Minister for Lands, and the Hon. J. Docker, Postmaster General, left Sydney at 8 o'clock in the morning, and arrived at the Mount Victoria station at about noon, where vehicles were in waiting to convey them to the scene of the explosion, a distance of 17 miles. The party arrived at the head of the valley at about 1 o'clock, and were conducted by Mr. Higgins, in a large cleared space on a level with the tunnel to be operated upon, and some 200 yards from it, where a tent had been erected, and where their luncheon provided. Having their appetites sharpened by the long journey, the party from Sydney, at dinner, and then sat down to a repast with keen relish the viands and wines before them. In the immediate vicinity of their tent was a long table supplied from the requisites of a good collection, liberally provided by Mr. Higgins for his friends, and visitors, some of whom had come from Bathurst to witness the blast. There were also present a large number of persons from Hartley, Berrigalong, and surrounding districts, besides a number of gentlemen from Sydney, including the Hon. Dr. Fergusson, the Hon. Thomas Smith, Mr. Piddington, M.L.A., Mr. G. Russell, of the firm of E. N. Rose & Co., Mr. Ross, and others.

Mr. Macleod of Hartley, was present, and Mr. Crankwell and Mr. P. B. Waller, in charging the battery and in making the preparation for the blast. We may also mention that Mr. Crankwell during the forenoon test of the wires and satisfied himself that the circuit was complete, by causing a slight shock, with a galvanic battery, through the whole length of wire.

In the afternoon, having been done to the extent of luncheon provided by Mr. Higgins, preparations were made for the explosion, and the party present began to disperse to various prospecting points where a good view of the effect of the blast might be obtained. The Hon. Sir John Lubbock, who had volunteered to fire the blast, with Earl B. Lubbock, Mr. Martin, Mr. Byrnes, Mr. Wilson, Mr. Higgins, and a few others, stood close to the table from which the electric spark was to be flashed, but the remainder of the party, about this time numbered several hundreds, probably not far short of a thousand, stood in various places further removed from the scene of operation. Lady B. Lubbock, having been instructed as to what she should do, at a given signal turned the circuit on to the right, and first noticed by the effect was seen and heard in a dense cloud of dust and stones being hurled into the air, and by a dull rumbling, rather than a loud sharp sound. For a moment the effect upon the rock could not be seen, nor, indeed, was it looked for by those who stood near the table, as their eyes were turned into the air to look out for falling stones; but as soon as the dust cleared away a little it was observed that the explosion had caused a wide descent in the top of the mass of rock which had thus become in a great measure detached from the cliff; and inasmuch as a portion of the rock lower down and outside was seen to be crumbling away, the enormous weight of rock above, the entire mass appeared to require but a push and the whole would tumble away into the gully below. The same reason which necessitated the removal of the mass in the first instance had now presented the prospect of the full force which it would have exhibited upon a solid rock; that is to say, a portion of the force of the powder had escaped through the fissures in the rock. The entire block was now completely shattered, and a few seconds after the blast was fired the roof of the tunnel fell in. It was the opinion of most people who saw the effect of the explosion that the whole body of rock, thus loosened and shattered, would speedily come down, a possibly after a fall of rain; and Mr. Higgins, who was well satisfied with the result, stated that if it did not come down of its own gravity it would only require a small shot in the top of the rock to topple it over.

Having made as close an survey of the blast operated upon as was consistent with safety, the party began to disperse. The Governor and suite walked down to their carriage, and entering them, drove back to the railway station at One Tree Hill. Before reaching the top of Mount Victoria the horses were knocked up, and the ladies as well as the gentlemen were compelled to walk. The party arrived at the station shortly after 8 o'clock, but in consequence of the 5 o'clock train from Sydney being on the line, the party did not leave till a few minutes to 10 o'clock. The train, without further incident, arrived in Sydney at a few minutes to 2 o'clock next, and the party, somewhat wearied with so long a journey, were glad to get back.

## No. 3.

## New South Wales Railways.

The Engineer in Chief to The Commissioner for Railways

Department of Public Works,  
Railway Branch,  
Engineer's Office, Sydney.  
30 January, 1872.

Sir,

I have the honor to report that the whole of the Government Railways in this Colony have been maintained, during the year ended 31st December, 1871, in good order and condition; and that the whole cost has been charged to the Vote for Working Expenses.

On the Southern Line, between Parramatta Junction and Liverpool, six miles and a quarter (6¼) of the Permanent Way have been entirely relaid with new sleepers and ballast.

On the Western Line, between Parramatta Junction and Blacktown, five miles and a quarter (5¼) of the Permanent Way have been relaid with new sleepers and additional ballast.

During the year, nine miles of the Northern Line, originally laid with half-round sleepers, have been entirely relaid with new sleepers and additional ballast.

The relaying of the Southern, Western, and Northern Lines, where half-round sleepers were originally laid down, will be proceeded with as rapidly as first-class sleepers can be obtained.

Under the head of Schedule B (Improvements and Additions to Works and Buildings), the sum of £5,779 12s. 7d. has been expended and charged to Working Expenses. This sum includes the enlargement of the Bridge at Newtown, upon which £1,761 6s. 10d. was expended; and also, £1,023 7s. for additional Signals at Stations.

I have, &c.,

JOHN WHITTON

# AUSTRALIA

BY EDWIN CARTON BOOTH, F.R.C.I.

*ILLUSTRATED WITH*

DRAWINGS BY SKINNER PROUT, N. CHEVALIER, ETC.

IN TWO VOLUMES

VOL. I.

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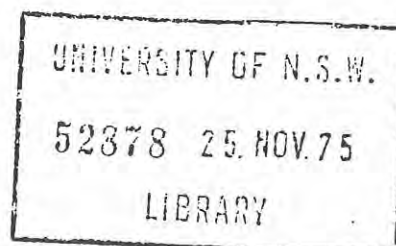
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Both of these islands are simple sandstone hills rising out of the water. Goat Island is used as a powder magazine, and Cockatoo as a convict settlement. They each contain immense chambers excavated from the solid rock, which are perhaps the best specimens of that most melancholy description of dwelling-place in the world. As the stream is followed up, the banks narrow in, the passage is made through orange groves, and the scene becomes one of exceeding beauty. The country was originally of a wild and rugged character; but the pleasant-looking houses, with their surrounding orange groves descending in terraces to the banks of the river, the quaintly arranged gardens, and the islands that here and there dot the water-way, take all characteristics of wildness away from the scene.

The town of Paramatta stands at the bend of the river, and has always been a place of considerable importance. The first governor of the colony selected it as the vice-regal place of residence, and, under the name of Rose Hill, it was once the one aristocratic settlement in the colony. It is now a flourishing town, having several extensive manufactories—in one of which Sydney tweed, a cloth of excellent quality, and having a high reputation, is made. Churches, schools, and kindred public institutions abound. The population numbers between 6,000 and 7,000.

Travelling west, the first place of importance arrived at is Penrith, a small town situate on the River Nepean, and surrounded by country of the character indicated in the sketches of the Cow Pasture, Fairlight Glen, and the Hawkesbury. After passing Penrith, the orange groves, that have hitherto given so much of character to the country, are lost sight of, and their place taken by high ranges and turbulent watercourses. Here and there a valley has been cultivated; but these occur at rare intervals, nor is a settlement of this kind likely to be very much added to. The railway is carried over the River Nepean at Penrith by means of a viaduct, that stands out in strange contrast with the wild country around. As an example of what has been done in New South Wales in the matter of engineering, it may be stated that this viaduct has three openings each 186 feet wide. The bridge proper—that is, the stone arches independent of the approaches—is over 600 feet long. The whole is constructed of solid masonry, and would be esteemed a creditable piece of engineering work in any part of the world.

West of the Nepean, the Blue Mountains, as distinguished from the Coast Range, rise up in vast irregular masses. Across and alongside the defiles of the hills the railway is conducted by a zigzag, or rather a series of zigzags. At the end of each section of the zigzag the trains are run on to a level

platform, the engines are then reversed, and so, foot by foot, the highest ridges of the mountains are attained. Once on the summit of the hills, the railway passes along the mountain-tops, and at an elevation of 3,700 feet the Clarence tunnel is passed through. For over sixty miles of the mountain journey the traveller can see on either side of him other mountains and forests, with here and there a turbulent stream dashing over the ledges of the rock, or rushing across the stony beds of deep dark valleys. After the railway has run a course of about eighty miles, it passes through a coal-bearing district, of which the principal town is Hartley, situate right in the heart of the hills. This place is destined to become one of very considerable importance. Already large quantities of kerosene are manufactured there; and now that access to the west is every day becoming more practicable, its treasures of coal will be largely utilised in the settlements on the lightly-timbered plains inland. The Falls of the Weatherboard are not far from Hartley, and nearer still there is a waterfall known as Govett's Leap. The air up in these mountain regions is of remarkable purity, and the settled places are sought after for the salubrity of the climate and the beauty of the scenery. Natural beauties abound in every direction; and wherever cultivation—always limited in extent—has taken place, the country possesses charms that may be sought for in vain in more easily accessible districts.

The descent from the mountains into the country of the western plains was a work of even more difficulty than the ascent from the rivers on the eastern side. Tunnels, bridges, and viaducts succeed each other at short intervals, and every mile of country travelled discloses fresh beauties and new objects of interest. The western line is not yet completed to Bathurst, and before this can take place the River Macquarie will have to be spanned by a bridge of considerable dimensions. This kind of difficulty is, however, made short work of in New South Wales; and the extension of the rail, not only to Bathurst, but to the far west beyond, will soon be an accomplished fact. A glance at the map will show how vast a stretch of country such a line of communication will open up, and how beneficial it must be to the trade of the eastern seaboard. Some day the Victorian line from Echuca and the New South Wales line may cross each other, and then the trade of the interior will be briskly competed for. When that day comes, and before it indeed, rivers and creeks will have been crossed, reservoirs formed, and wells sunk; here and there agricultural settlements will have been formed, the rich natural pastures of the country will have increased in richness, and instead of wool only, with beef and mutton as a matter of course, the waggons will be

# PICTURESQUE ATLAS

A237

v/3

OF

# AUSTRALASIA

EDITED BY

HON. ANDREW GARRAN, M.A., LL.D., M.L.C.

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ASSISTED BY LEADING COLONIAL AND AMERICAN ARTISTS

*WITH OVER EIGHT HUNDRED ENGRAVINGS ON WOOD*

VOL. III

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219

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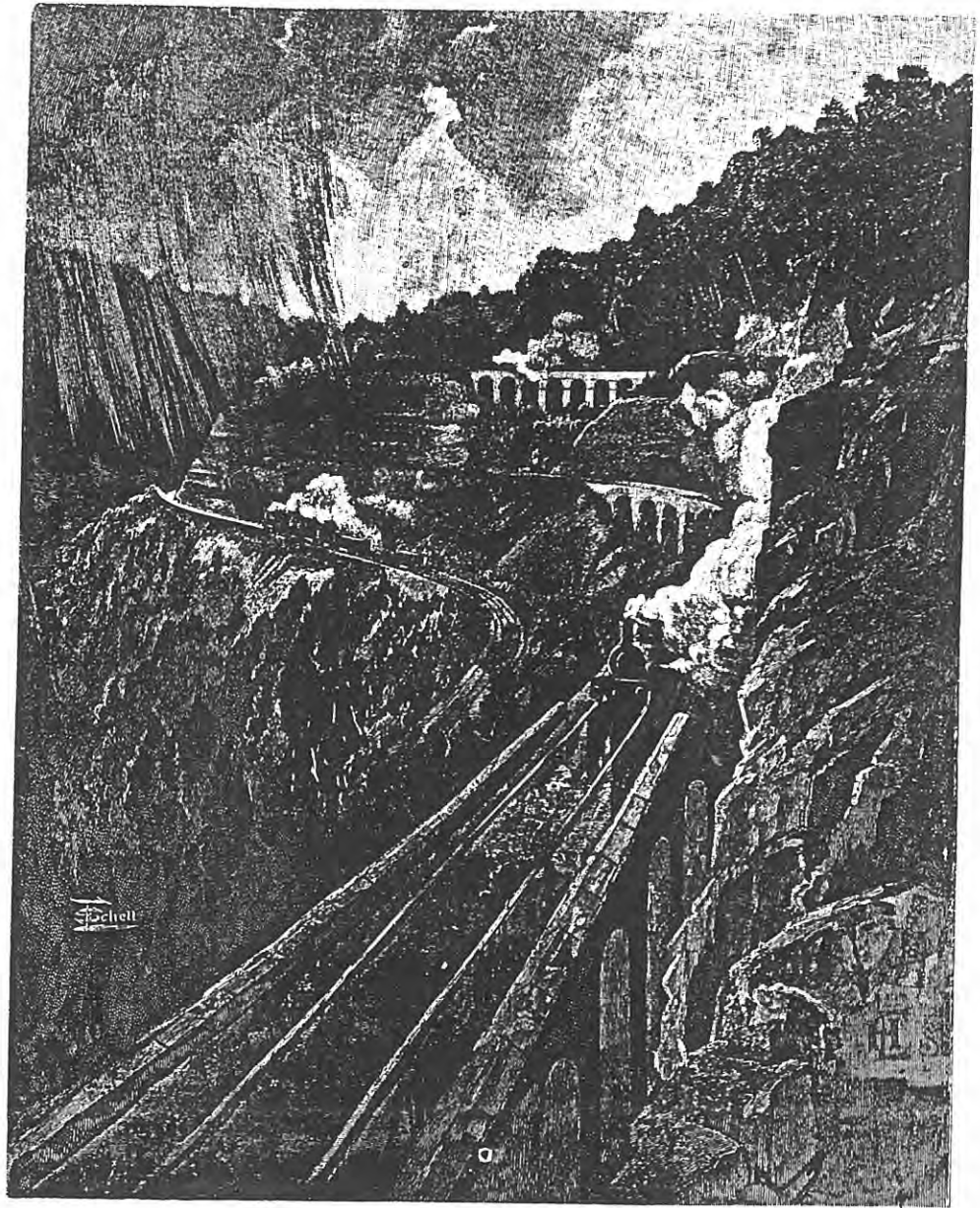
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1886



the line was opened. The first section of the South Australian railway was from Adelaide to Port Adelaide, and the next was from Adelaide to Gawler, which was opened in October, 1857, the distance being twenty-five miles. In New Zealand the first line thrown open was at Lyttleton, Canterbury district, on December 1st, 1863. Queensland followed, on July 31st, 1865, with a line from Ipswich to Toowoomba; Tasmania opened its first section on August 19th, 1869; and the first sod of the West Australian lines was turned by Governor Weld on November 22nd, 1874. The progress in all the colonies has been in every way wonderful when the sparseness of the population and their resources are taken into consideration. In New South Wales, after the opening of the first short line, the work of railway construction languished somewhat for at least twenty years, though only three were allowed to pass without at least some progress being made. Those exceptions were the years 1859, 1865, and 1866. When the two decades had passed only 437 miles were open in the mother-colony; by 1885 a distance of 1,832½ miles was traversed by the rails; and at the end of 1887 the total length of railway line in the colony reached 2,036 miles, giving an average of about 62 miles per year. To this is to be added the private line between Moama and Deniliquin, connecting with the traffic from Echuca. The cost of the government lines up to 1887 amounted to £28,911,224. The routes are known as the Great Northern, Great Western, and Great Southern lines. The first, which for many years had its termination at Newcastle, has now been connected with Sydney by a junction at Homebush, and one of the great works is the bridge over the Hawkesbury River, estimated to cost when finished £327,000. The line taps the Newcastle coal district, the agricultural valley of the Hunter, the rich pastoral country of New England, connecting with the line to Brisbane on reaching the Queensland border. The Western line crosses the Blue Mountains over that marvel of engineering skill known as the Zig-zag, and passes on by Bathurst and Dubbo to Bourke. The chief line in New South Wales is the Great Southern line, branching from the junction at Granville and traversing the southern districts through Goulburn, Wagga Wagga, and the other principal towns on the route, to Albury, where a junction is effected with the Victorian line to Melbourne.

The connection of the two chief cities, the most important feat of railway construction in Australia, was finally effected by a bridge over the Murray at Wodonga in 1883. Besides these main lines there are many subsidiary lines and branches. In 1887 the number of persons carried over the lines in New South Wales reached 14,451,303; the tonnage of goods carried being 3,337,253 tons for the same year. The average cost per mile is calculated at £11,037. The interest for 1887 on the total



THE ZIG-ZAG, NEW SOUTH WALES.

capital expended amounted to £1,663,938, leaving a net deficiency for the year to be paid out of general revenue, of £313,404. The whole railway and tramway system has lately been placed under the control of three commissioners in order to relieve the management from political influence.

From the first steps towards railway construction in Victoria, in 1853, the progress was rapid. A private line to St. Kilda was opened in 1857, and one to Geelong in the same year. The Government constructed at great expense a line from



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1889.

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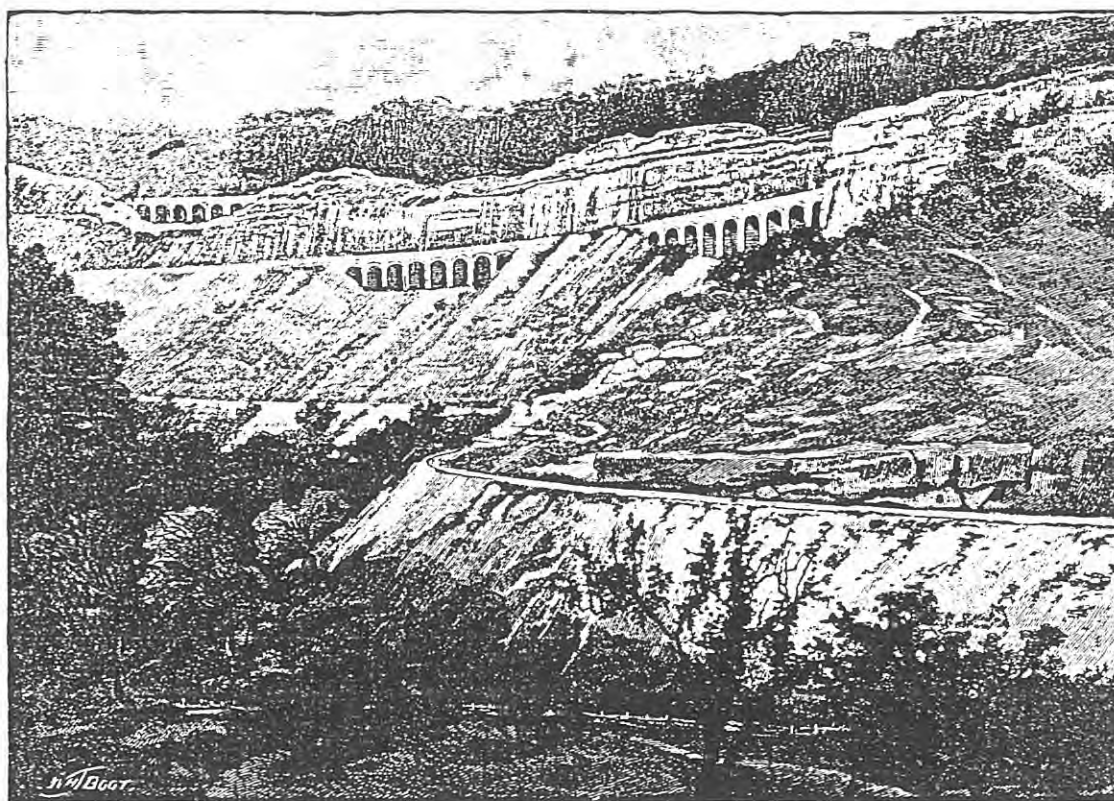
platforms, at last find ourselves in one of the comfortable saloon-carriages of the western train. Far away on the horizon we can just see a faint outline of sky-blue hills fading into the haze of the morning sky, and as the rushing carriages bear us over flat plains of grass and corn land, what before seemed a rim of high ground now looms larger as a great mountain rampart sloping steeply to the level land below. We clatter over an iron bridge, beneath which is a splendid stretch of river, straight as an arrow for a mile or so. "What a reach for a boat-race!" remarks our tourist. But he has hardly finished examining the river scene when his attention is attracted to the slow, upward toiling of the train, which is now beginning to climb a zigzag track to the summit of the ridge. He listens to the "pull-a-bit and shove-a-bit" of the two engines as they drag their load past Knapsack Gully—a name that recalls the tramping of early pioneers—and then rushes to the window to gaze his fill on the splendid panorama below. The train is running for a short distance along the mountain ridge, and immediately beneath flows the stately Nepean, with the tiny farming town of Penrith, now looking like a dolls' village, on its banks. Beyond stretches forty miles of verdant plain, and in the dim distance the headlands of Sydney Harbour can just be discerned. But giant gum-trees rush enviously in and obscure the view, so the traveller settles down to read his railway volume, until "Mount Victoria," called lustily by station porters, informs him that he has reached nearly the highest point of his long ascent.

Here we are in the heart of the Blue Mountain scenery, and by alighting and taking up quarters at the "Imperial," or any other comfortable hotel, easy excursions might be made to the great gorge of Govett's Leap, or to Wentworth Falls; but as our present destination is Bathurst, we only avail ourselves of the twenty minutes' stoppage for refreshments, and retake our seats near the windows on the look-out for any glimpses of mountain scenery that may be caught as we rush out of the numerous railway cuttings. And they are not few, nor wanting in grandeur. Now it is a view of wide mountain valleys, overspread with the grey-blue tint of thousands of gum-trees, while tall bare pillars of sandstone, like the rock columns of the Needles off the Isle of Wight, stand out in relief, and pass in panoramic fashion slowly before the revolving background. Glancing over this vista of labyrinthine valleys, it is not hard to realise how even experienced countrymen can get lost in the bush, or to understand the difficulties of Wentworth, Lawson, and Blaxland, in their pioneer march across the ridges.\* Hardly has the train passed this broken ground than, issuing from a long tunnel, our course begins to descend, the siding which we have just left being the highest point of the line. Before long a close observer notices that the telegraph wire has left the railway track, and is carried abruptly down the valley at right angles to our course. This is the first indication that we are approaching the well-known Lithgow Zigzag, whose singularity as a piece of engineering, and whose beauty as a specimen of scenery, are usually pointed out to visitors by their colonial hosts. In three long curving gradients the Zigzag leads down a valley of some 700 feet, and though to the stranger the sheer slope of the embankments, the height of

\* *Vide* p. 273

the stone bridges, and the gathering rush of the train as it whirls round great bluffs of rock, may at first be somewhat startling, yet the view both from above and below will charm him with curving outlines of masonry and constantly changing glimpses of glen and crag. Just beyond the Zigzag lies what seems destined to be the Birmingham of New South Wales. Already the tall chimneys of smelting-works show that Lithgow coal is being put to good use. Here iron rails are rolled out, pottery is fashioned, and a hundred black embankments indicate the industry that fills those long lines of railway trucks which run to the pit's mouth. All coal-mining centres have their tragic stories, and Lithgow does not prove the rule by exception. Some time ago one of the largest and most productive of these mines caught fire, several men losing their lives, and when a fairly successful attempt had been made to smother the conflagration by stopping up all the shafts, by one man's mistake the whole work was undone, three more lives were lost, and the pit had to be flooded.

We will now push on to Bathurst. We are rapidly descending a long, winding incline, apparently following the track of some mountain stream, and the high ranges



THE LITHGOW ZIGZAG.

begin to be succeeded by "foot-hills," as a Californian would call them. They are still shaggy with bush; but on a sudden, as we turn out of one of the numerous cuttings, the wooded hills seem to gather up their leafy robes and stand aloof from the wide, undulating plains that come into our view, green with grass and with young corn,

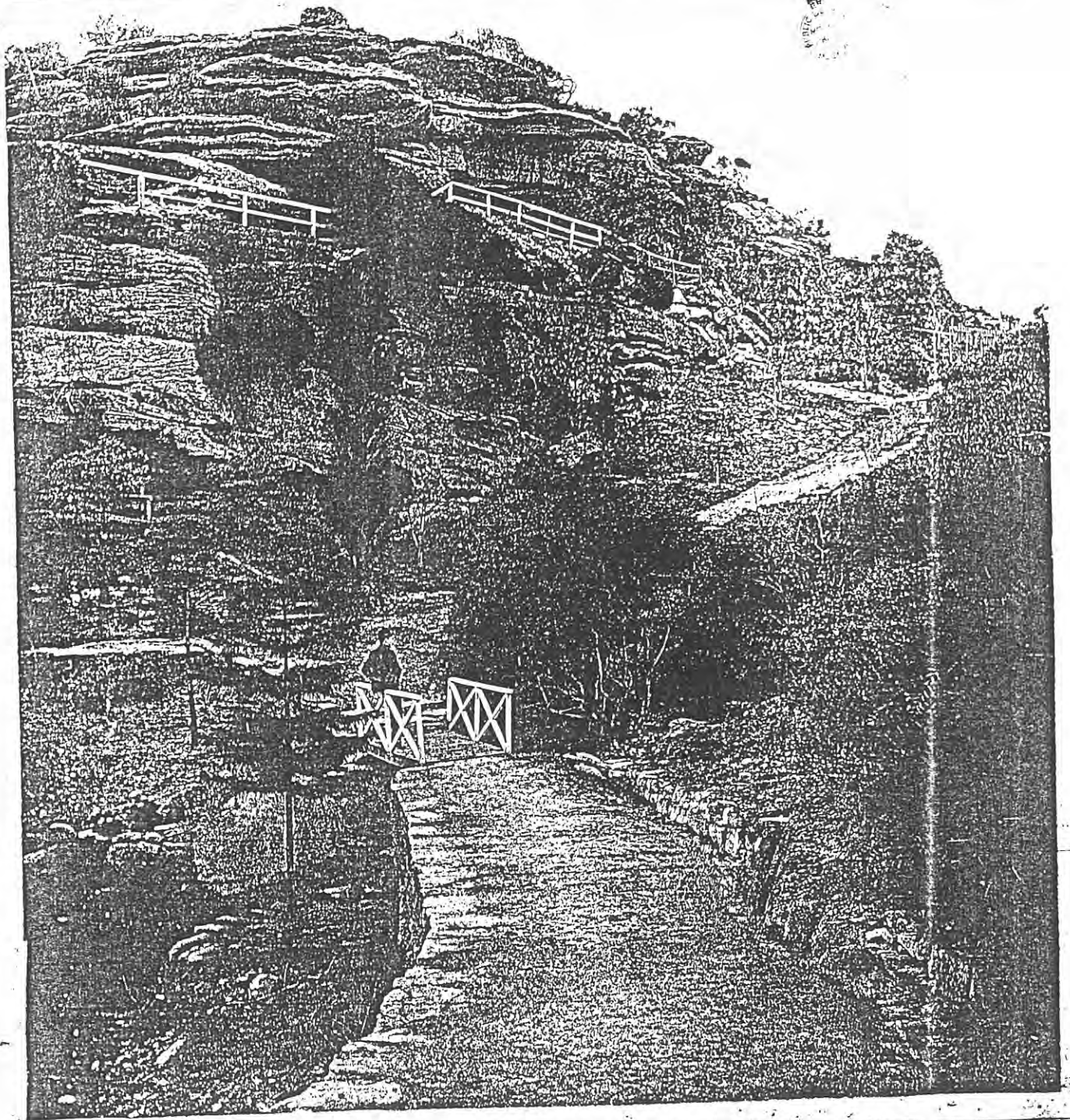


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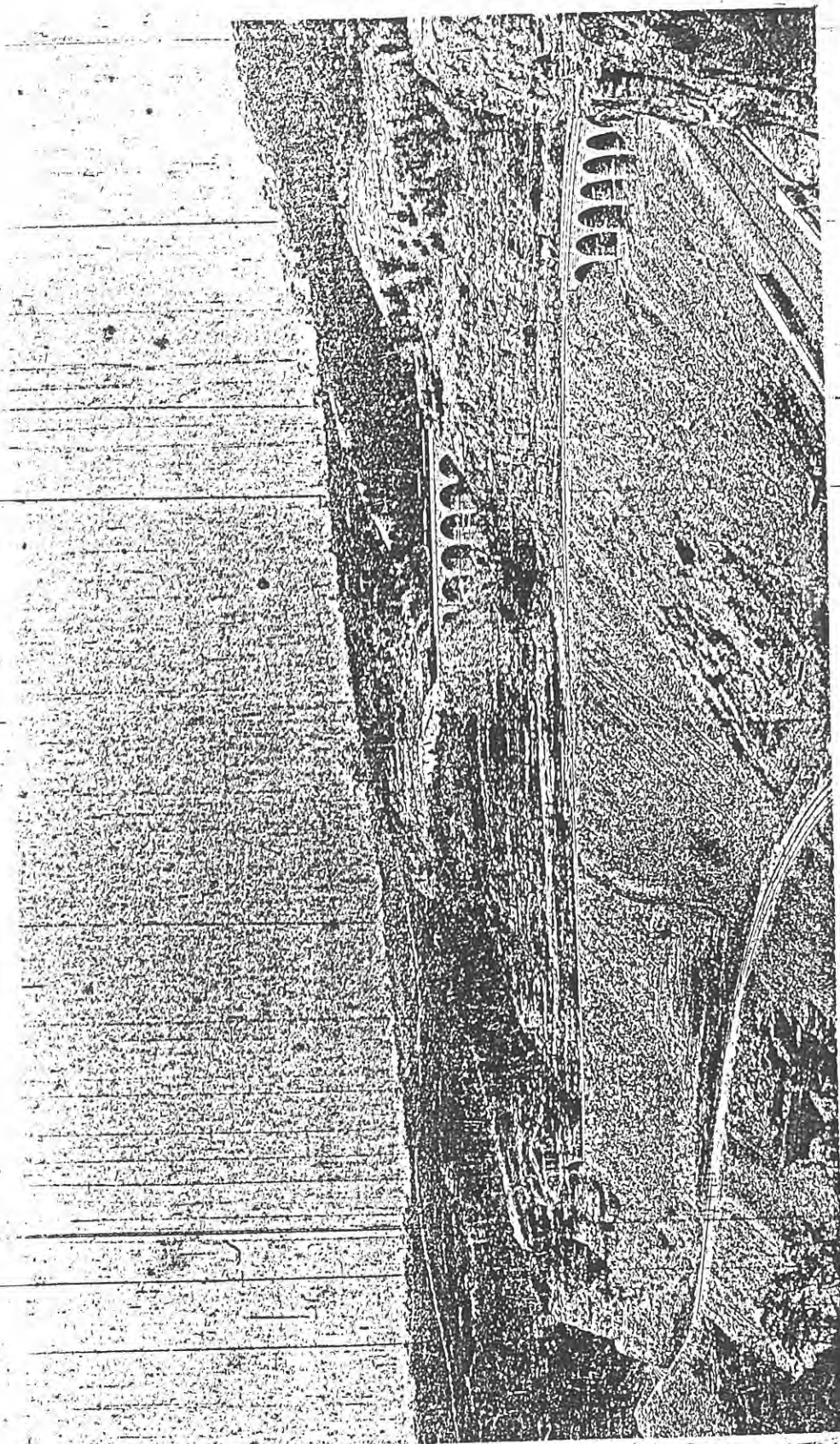
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THE GREAT ZICZAG, MOUNT VICTORIA, N.S.W.

execution of these works two gigantic masses of rock—the one estimated to contain 40,000 and the other 45,000 tons—had to be blasted; and the contractor, after calculating the cost, determined to call in the aid of electricity for that purpose. For the first mass of tons of blasting powder was employed, and the Superintendent of Telegraphs (Mr. E. C. Cracknell) succeeded in firing the blast, which tore the mountain asunder, heaving cut huge masses of rocks into the valley and leaving the face of the parent mountain as smooth as if it had been cut with chisels. The removal of the second mass—the blowing up of a tunnel—for which 25 tons of powder were used, was successfully accomplished also by galvanic agency; the electric spark having been communicated by the Countess of Belmore in the presence of the Governor and a large concourse of spectators who had assembled to witness the effects of the explosion.

Since the opening of the railway over the Blue Mountains thousands of tourists have availed themselves of it to examine these works, and express their unbounded admiration both of the rugged grandeur of the scenery and the engineering skill displayed in designing and constructing these stupendous works, which are probably not surpassed on any railway in the world. But a description or even an inspection of the Lithgow Valley Ziczag gives only an imperfect idea of the difficulties that had to be encountered and the vast amount that had to be performed before it was hewn into the present shape. From the Clarence Tunnel to the bottom of the valley there is a descent of 4700 ft. through a deep and rugged ravine, where formerly there was scarcely footing for the mountain goat, and where the surveyors' assistants had occasionally to be suspended by ropes in the performance of these perilous duties, but human skill and enterprise have opened a pathway through these broken mountain ranges, for the railway train that now traverses the sides of the mountain on a gradient of 1 in 42.

THE  
*CYCLOPEDIA of N.S.W.*  
(ILLUSTRATED)

Under the Patronage of Vice-Royalty,  the Government of New South Wales.  
and the Lord Mayor of Sydney . . .

*An HISTORICAL and COMMERCIAL REVIEW.*

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DESCRIPTIVE AND BIOGRAPHICAL, FACTS, FIGURES AND ILLUSTRATIONS

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*An EPITOME of PROGRESS.*

NEW SOUTH WALES:  
McCARRON, STEWART & CO., PRINTERS, 44 PITT STREET, SYDNEY.

1907.

bourne a line from Flinders Street to Port Melbourne, 2½ miles, had already commenced running on September 13, 1854, and this was the first railway opened in Australia.

At the period when the Sydney-Parramatta railway was opened Sydney was a comparatively small place, and the driver of the first train, relating his experience of the opening day, stated that the country between the metropolis and Parramatta "was nearly all bush, with a stray public-house here and there on the roadside." The largest crowd—on the basis of population—that ever collected in Sydney witnessed the opening ceremony and displayed much jubilation. On that day no less than 2,000 passengers travelled from terminus to terminus, Governor Denison setting the example to show the people there was nothing to fear in using such a mode of conveyance. There were three classes of carriages—first, second, and third; the train being only 178 feet long, and drawn by a No. 1 four-wheel locomotive, from the workshops of Robert Stephenson & Sons, Newcastle-on-Tyne. In going to Parramatta 39½ minutes time was occupied, and the return journey took an additional 6½ minutes. The rolling stock at the start consisted of only four locomotives, with a total traction power of 37,784 lbs.; 28 passenger carriages with an aggregate seating capacity of 924 persons; and 51 goods vehicles, with a gross carrying capacity of 306 tons. Evidently the preference of the Government did not allow sufficiently for development, but the *S.M. Herald* took a broader and more enlightened view. Writing of the opening in the following morning's issue, that paper said: "It is very difficult to record with quiet and unexcited feeling an event of this description. The great fact of Saturday in this colony will prejudice—the substantial national benefit to be derived from it will defeat—party spirit. New South Wales has advanced quickly in the stage of community. Little more than half a century has elapsed from her birth, and she has through many difficulties, become a great colony. Give her railroads and she will become a great nation. The railway to Parramatta is now complete. This cost the colony more than half a million of money. None who have tried the railway to Parramatta will be content to stay there." The cost of construction was more than six times as much as would complete the whole 134 miles to Goulburn; and what was worse, after a comparatively short time the line had to be relaid at an expenditure which made the cost of the railway not less than £50,000 per mile. Whilst the passenger traffic was satisfactory at the start, the same cannot be said of the goods traffic. For the first three months that the line was opened 140 tons of general merchandise was carried, with £156 as the earnings, the carrying capacity of each waggon being only 6½ tons.

The progress of railway construction was very slow, owing to some extent, no doubt, to lack of enterprise, but also to the engineering difficulties connected with the first sections out of Sydney, as the southern and western ranges had to be crossed within a hundred miles of the metropolis, the western one involving the construction of the track across the Blue Mountains, necessitating, amongst other works, the use of the zigzags known as Lapstone Hill (since cut out) and

the Great Zigzag into the Lithgow Valley. These were designed and given practical effect to by a former chief engineer, Mr. John Whitton, whose skill, pluck, and perseverance in prosecuting the difficult undertaking are referred to frequently in the State's official records. The blasting operations which were necessary have been set forth by Mr. John Rae, M.A., who was commissioner for railways at the time, in a report which was presented to Parliament on April 21, 1873, in the following words: "In the execution of these works two gigantic masses of rock—the one estimated to contain 40,000 tons, and the other 45,000 tons—had to be blasted; and the contractor, after estimating the cost, determined to call in the aid of electricity for the purpose. The first mass to be operated upon was a spur of the mountains a few hundred feet from the first reversing station, which blocked up a portion of what is now the middle line of railway. Preparations were accordingly commenced by excavating a trench on the top of the rock, in the line where the division was required to take place, and drilling in this trench 25 triangular holes, 30 feet deep, and of sufficient capacity to be charged with 3½ tons of blasting powder in all. Mr. Cracknell, superintendent of telegraphs, fired the blast on January 5, 1867. It tore the mountain asunder, heaving huge masses of rock into the valley, and left the parent face of the mountain almost as plain as if it had been cut with chisels. Mr. Whitton, himself a strong-minded man, met in Governor Sir Wm. Denison another. The Governor was opposed to the chief engineer's proposal to take a locomotive over the Blue Mountains, and he denounced the scheme as an impossible one. Mr. Whitton therefore awaited the arrival of the new Governor, Sir John Young, to whom on July 31, 1861, he submitted fresh railway proposals, and won his cause.

At the end of 1869 the length of the lines in operation had only reached 318 miles, the extension being at the rate of about 21 miles per year. The lines constructed were—Granville to Liverpool, 8 miles 64 chains; near Newcastle to East Maitland, 17 miles 8 chains; near Newcastle to Newcastle, 1 mile; Liverpool to Campbelltown, 11 miles 68 chains; East Maitland to West Maitland, 2 miles 11 chains; West Maitland to Lochinvar, 6 miles 11 chains; Parramatta to Blacktown, 7 miles 17 chains; Blacktown to Rooty Hill, 3 miles 65 chains; Lochinvar to Branxton, 8 miles 12 chains; Rooty Hill to South Creek, 5 miles 8 chains; South Creek to Penrith, 3 miles 57 chains; Campbelltown to Menangle, 6 miles 47 chains; Branxton to Singleton, 14 miles 39 chains; Menangle to Picton, 12 miles 30 chains; East Maitland to Morpeth, 3 miles 38½ chains; Blacktown to Richmond, 16 miles 19 chains; Picton to Mittagong, 25 miles 20 chains; Penrith to Weatherboard, 26 miles 63 chains; Mittagong to Sutton Forest, 8 miles 64 chains; Weatherboard to Mount Victoria, 15 miles; Sutton Forest to Marulan, 29 miles 28 chains; Singleton to Muswellbrook, 31 miles; Marulan to Goulburn, 17 miles 7 chains; and Mount Victoria to Bowenfels, 20 miles 2 chains. Fifteen years it took the Government to take the line to Goulburn, a project which the promoters of the railway company contemplated carrying out right away from the start. Not a single mile of railway was



## NEWSPAPERS

The contemporary newspapers carried regular reports on all railway matters, which reflected the intense public interest in this new (for the colony) form of transport. Articles about railway construction were presented in detail, sometimes based on site visits by the reports and others, and sometimes as summaries of official reports.

Apart from the two large bridges over the Nepean River (at Menangle in 1863 and at Penrith in 1867) the crossing of the Blue Mountains was the major engineering work of the 1860s. The Zig Zag at Lithgow received particular attention.

We are fortunate that a useful summary of newspaper references was been published in 1977 by the noted historian William A. Bayley. A copy of the title page of the book, which runs to 120 pages, is attached together with a sample article.



THEN

*The "push-up" engine became the "pull-up" engine on the middle road, the train engine being out of sight around the curve.*

H. PHILLIPS, KATOOMBA

# The Great ZIG ZAG RAILWAY at Lithgow

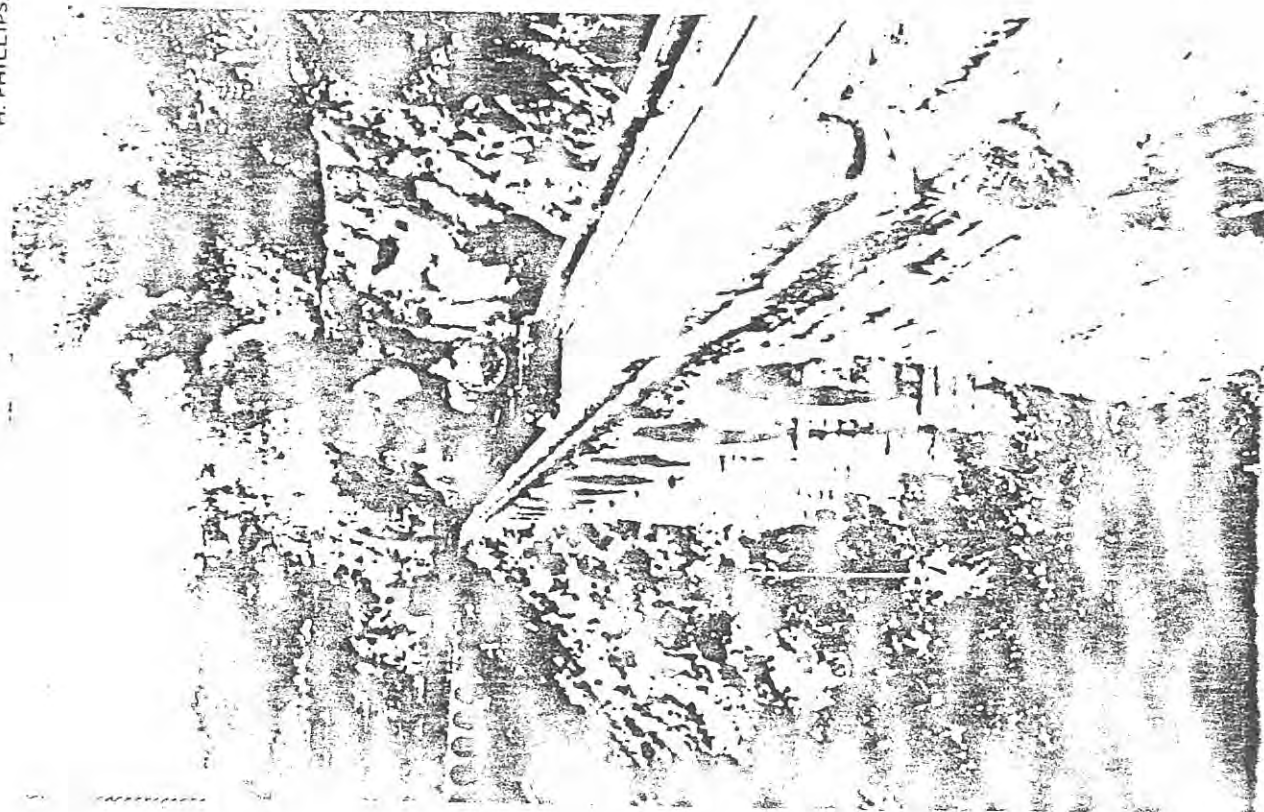
by  
William A. Bayley.



AUSTRAIL PUBLICATIONS

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1977



## GROWING INTEREST IN OLD ZIG ZAG

INTEREST in the former Great Zig Zag Railway at Lithgow, already at a high level, received a further boost with the formation of the Zig Zag Railway Co-operative Ltd., which with assistance from government funds began the project to lay down the railway again in stages. Motorist passengers will be able to arrive by car, ride down the zig zag railway and back, and rejoin their car for their homeward journeys — a remarkable historical outing indeed.

The stage up the middle road, through the tunnel and over the viaducts, began operating in the latter half of 1975 and continues.

Interest in the pioneer Austrail Publications booklet about the zig zag saw the sale since the centenary in 1969 of some 10,000 copies in three editions. The clamour for more information has brought this new volume in which a large part is taken from the actual accounts of the time when the events occurred. Additional pictures and diagrams enhance the value of the volume.

The author owes a debt of gratitude to the librarians and staffs of the Library of New South Wales and the Mitchell Library for assistance with the preparation of the story and to Pacific Film Laboratories (Australia-wide) for preparation of the illustrations.

Valued assistance has also been received from the Latrobe Library in Melbourne; N.S.W. Transport Commission (Archives of the Railways); Department of Main Roads; Australian Railways Historical Society; Lithgow Zig Zag Trust and Lithgow City Library; Royal Australian Historical Society; N.R.M.A.

Further thanks are tendered to all who have sent to the author and to Austrail Publications additional old photographs and information. Finally special thanks are tendered to J. W. Bayley, also a railway enthusiast, who has prepared the diagrams.

THE AUTHOR

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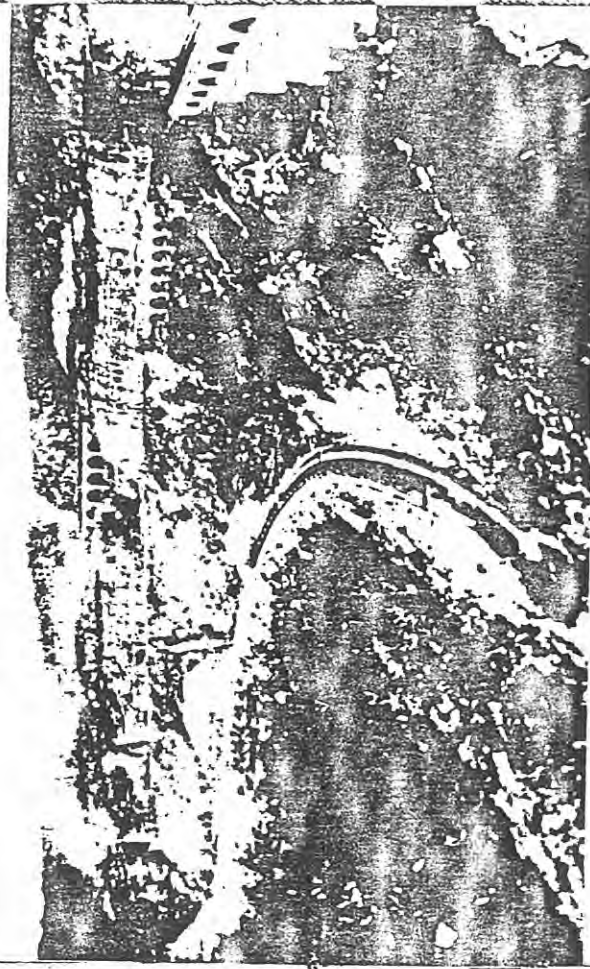
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## ACHIEVEMENTS UNPRECEDENTED

STUPENDOUS engineering feat of the nineteenth century, the Great Zig Zag Railway at Lithgow remains the memorial to the planners who devised the means by which trains were taken up and down the mountain-side, an achievement thought to have been impossible by the early leaders of the infant colony of New South Wales.

Its construction was considered one of the greatest phenomenon of the time; its use a triumph of the skill of railwaymen in all categories and its replacement another gigantic undertaking of great magnitude.

Its abandonment was all that could be hoped for in the age of horse-drawn vehicles which railways replaced, for with the deviation of the line, access to the former great tourist attraction was debarrained until the coming of the era of the motor vehicle.



*The zig zag railway showing a train climbing the lower road; another emerging from the tunnel on the middle road and another crossing the viaduct on the top road.*

MITCHELL LIBRARY

*The Argus (Melbourne) 31/8/1869  
p6, 7 (reprinted in The Sydney Mail  
p6 11/9/1869)*

## AN EXCURSION TO THE BLUE MOUNTAINS, NEW SOUTH WALES.

(FROM A CORRESPONDENT.)

The writer had an opportunity recently of paying a visit, under very favourable circumstances, to the imposing scenery of the Great Barrier range which divides the seaboard of New South Wales from the western interior, and the following jottings are intended not only as a memento of a most agreeable trip, but as recording some particulars of the greatest work in railway engineering which has yet been attempted in these colonies.

The excursionists were a party of Victorians then on a visit to the sister colony on public business. The public men of the city were lavishing their hospitalities on the Victorian visitors, and amongst the invitations which the latter received was one from the hon. the Commissioner of Public Works for an excursion by special train to the far-famed zig-zag and the scenery of the Blue Mountains.

The day which had been fixed for the event was preceded by a week's continuous rain, and the flood which it occasioned in the valleys of the Nepean and Hawkesbury, as well as the injury done to several public works, suggested as a matter of prudence the postponement of the intention for a couple of days. This change we had no reason to regret. The rains had ceased, and a genial sunny day, with just a little crispness in the mountain air, contributed in the utmost degree to our enjoyment. Our start from the Redfern Station, at Sydney, was made at eight a.m. The party consisted of ten Victorians, accompanied by the hon. the Treasurer and some other well-known citizens of Sydney. The train was composed of a long saloon carriage, and merely a guard's box, with breaks. The saloon carriage was fitted with wheels on the Bogie principle, to adapt it to the sharp curves which are met with in the mountains. These carriages are of lighter build than those on the Victorian lines, and the amplitude of glass on either side affords every facility for seeing the country right and left of the railway. The first few miles out of Sydney are not particularly interesting. The country is slightly undulating, with belts of timber here

and there, and occasionally a substantial country residence or a fertile patch under cultivation. The line as far as Paramatta (fourteen miles) has been open for some fourteen years, and thus far one line serves for both the Western and Southern Railways, the Paramatta station forming the junction;

Pursuing the course of the Great Western line, the next station of any importance is that of Penrith, about twenty miles distant. The larger portion of the line for this distance was constructed by Mearns, Peto, Brassey and Betts, and the last section was completed about seven years ago.

The scenery improves after leaving Paramatta station. The town of Paramatta, as seen from the railway, is remarkably pretty, and the valley of the Paramatta River above the town has a fertile and English look about it. Travellers always look out for the avenue of oaks—the oldest in the colonies—in the "domain" once the gubernatorial residence of Sir Charles Fitzroy.

There are no engineering difficulties between Sydney and Penrith. It is only beyond that point that the line becomes interesting in its engineering aspect. The town of Penrith has evidently sprung into existence from its becoming the halting-place of the numerous drays and waggon travelling into the interior. Here they rested before making the ascent of the Blue Mountains, or after having on their return trip accomplished the descent. At this point, then, commences that portion of the railway works which are certainly the most remarkable of any in the Australian colonies. From the Penrith station the line runs direct towards the ascent of the Blue Mountains, but it has to cross the River Nepean and the Emu Plains in its way. Our train pulled up at the river to enable us to descend, and view the works of the great viaduct across it. This magnificent bridge is of the iron tubular kind, the girders resting upon four massive piers of freestone, of a bright yellow, but about 180ft. apart. The base of the two centre piers in the bed of the river is about 60ft. by 18ft., tapering upwards. When visited by our party, the contractors were engaged in fixing large iron cylinders at the west end of the bridge, which are to serve instead of stone piers, and to carry another girder of 125ft. span, in the place of the timber approaches hitherto used. The bridge has cost already over £100,000. Both it and its approaches for a long distance had

to be carried to some 40ft. above the water level on account of the destructive floods which sweep down this valley, one of which was only subsiding when we visited it. As there is no other way of crossing this valley, the bridge carries the cart road as well as the railroad.

Across the Emu Plains the line is carried over embankments and timber viaducts until it commences the ascent of the mountains at a gradient of one in thirty. The course of the railway is now along the mountain ridges, but still ascending at the rate generally of from 1 in 30 to 1 in 40, with perpetual curves, some of which are very sharp—eight chains radius. There are numerous cuttings through hard sandstone rock, and some rather heavy embankments. An idea may be formed of them from the fact that several of the cuttings involved the removal of over 30,000 yards of stone, and one was over 50,000 yards. Beyond Wascoe's we came to several stations, including the Blue Mountain Inn, the Weather-board, Blackheath, and ultimately to Mount Victoria, which is the present terminus, and which is distant seventy-six miles from Sydney. At this point the line is about 3,600ft. above the level of Sydney Harbour.

Thus much it has been thought necessary to say about the railway and its construction, but it must not be supposed that the forty miles or so between Penrith and Mount Victoria were passed over by our party of Victorians in merely jolting down in a matter of fact way such notes as these. From Wascoe's for a few miles it is true that there was nothing in the scenery to attract very particular notice, but we see that beautiful phenomenon which has given to this range the name of the "Blue Mountains." No artist can exaggerate—indeed, no artist can approach—that lovely blue that pervades the whole valley, deepening as the view recedes, and changing with the hour or the state of the atmosphere into different forms of loveliness, but always inexpressibly beautiful.

On this enchanting scene the memory lingers with delight. But we must hasten on our journey. At the Victoria station—a very comfortable one, built of light freestone—we were met by a Victorian friend—Mr. P. Higgins, the well-known contractor—who has had the execution of the works at the further zig-zag, which constitute the descent from the mountain on its western side into the Lithgow valley. By a pre-arrangement between the hon. the Minister of Works and Mr. Higgins, the line then approaching completion beyond Mount Victoria, had been cleared for us, and with Mr. Higgins on the engine to pilot us, we proceeded at a good pace on to the Clarence

tunnel. For the greater part of the distance the line here runs along a narrow sort of the mountain with the most picturesque views on either side. The valleys still bear the rugged character of the great horseshoe, but more broken and irregular, with not single outliers, but extensive groups of rocks rising at short distances from each other like ruined cities with castles, temples, and stupendous buildings all gone to desolation and decay. Before reaching the Clarence hill the greatest elevation is reached, namely, 3,600ft. above the sea level. This tunnel is 640 yards long. It is lined with freestone set in cement, although cut through solid rock. Beyond the tunnel the line begins to descend, and the section containing the heaviest work of all (Mr. Higgins's) commences. After a small piece of level line comes a cutting, through very hard rock; then a long and deep embankment, then a cutting, in which between forty and fifty thousand tons of rock had to be removed. Here commences the descending zig-zag—a much more magnificent piece of engineering than the ascending zig-zag near Penrith; it ranks, in fact, amongst the greatest engineering works at present in progress throughout the world. The gradient here is 1 in 42. The road winds to the right in curves of from 30 to 10 chains radius. Heavy cuttings and embankments follow each other. Some of the chasms are crossed by viaducts. The first of these is a beautiful structure of hard white freestone. It is built on a curve of ten chains radius, has seven arches, five of which are of 30ft. span. On this viaduct our party stopped for some time, to enjoy the glorious scenery which the eye can take in from this point. At the end of the viaduct commences a tremendous cutting, from which about 100,000 yards of solid stone have been taken, the face of the cutting in some places being 60ft. high. This leads to the first reversing station, where the line terminates abruptly before a massive wall of rock. On clambering round the side of the hill, we discovered that if this block of stone had been cut through for the distance of another chain or so a fearful precipice would have been reached. Here, however, the line takes a reverse course down the mountain side. Another beautiful viaduct is soon reached, consisting of nine arches of 30ft. span. Its length is 330ft., and the height of the piers from the surface of the ground to the rails above is 76ft. The difficulty of constructing these works must have been enormous. The line is cut along the sides of a steep cliff, and the intervals between the projecting ledges of rock which carry the line have to be bridged over by these viaducts. The

WHO DID IT ?



JOHN WHITTON



# JOHN WHITTON

" Father of NSW Railways "

John Whitton developed the railways of New South Wales during the second half of the nineteenth century from a set of primitive city-based railway lines in Sydney and Newcastle to a network of 2,171 miles of tracks throughout the colony. This comprehensive rail network connected the main parts of New South Wales and formed a well planned structure which became the foundation of the present rail system.

Whitton was born in Wakefield, Yorkshire, England in 1820. For seven years during his early adulthood he was articled to John Billington from whom he gained engineering and architectural experience preparing plans and tenders for railway constructions and waterworks. He further consolidated his engineering career when he was employed under two famous British civil engineers, John Hawkshaw and later with John Fowler.

During this time, Whitton was influenced by the high standards of construction used in Britain based on two golden rules:

1. that adoption of a uniform track gauge was operationally sound and
2. that initial high standards, although expensive, were best in the long term.

Both ideals were to involve Whitton in technical and political disputes during the following 35 years he spent with the New South Wales Government Railways.

In March 1856 he was appointed by the British Board of Trade to the position of Engineer-in-Chief to layout and construct railways in New South Wales at a salary of 1,500 pounds. When he arrived with his family in Sydney in December 1856 there were only 23 miles (37 km) of railways near Sydney and 17 (27 km) near Newcastle. Immediately the dual questions gauge and standard of construction had to be resolved and Whitton was in direct conflict with Governor Denison and successive colonial governments. Despite the technical strength of his arguments he was only partially successful in each case.

On the former he was able to prevent breaks of gauge within New South Wales but could not persuade the Government to adopt the Victorian 5ft-3in (1600 mm) gauge so New South Wales retained the 4ft-8 $\frac{1}{2}$ in (1435 mm) gauge.

On the latter, Whitton successfully opposed plans to construct cheap light railways operated by horses and was able to build the first of the railway extensions to a high standard operated by steam locomotives. However, the consequential demands on the colony's scarce resources meant that Whitton was forced to make concessions over the next 30 years in order to keep costs within tight budgetary controls. Although standards of track and structures remained relatively high, gradients were steepened, smaller-radius curves were used and the standard of ancillary items such as station layouts, buildings and fences were reduced.

The first major works under Whitton's direction were the extensions from Liverpool to Goulburn and from Penrith to Bathurst. Two large wrought iron bridges were built across the Nepean River, at Menangle in 1863 and at Penrith in 1867. Both are still in use, the former still for railways and the latter as a road bridge. In order to climb and descend the Blue Mountains Whitton chose to use two zig zags, the Little Zig Zag on the eastern side at Lapstone and the famous Great or Lithgow Zig Zag on the western side. When these extensions and that from Maitland to Murrumbidgee were completed in 1876 there were 445 miles of main line railways.

The next fourteen years saw a rapid expansion of railway construction such that by 1890 the network had nearly 2,200 miles of railways. John Whitton and his staff had prepared most of the designs and plans and had supervised all the contracts. In the case of bridges they test loaded them before approving them for regular traffic. Some of the principal works of this period were many long timber viaducts across wide river flood plains, twelve lattice girder bridges, the first Hawkesbury River Bridge and many tunnels varying in length from 500 feet to 5,200 feet, in deep rock cuttings.

Design checks of the lattice girder bridges and of the Hawkesbury River Bridge were carried out by Whitton's brother-in-law John Fowler. This family tie was the source of charges of corruption against Whitton but enquiries proved them groundless. Sir Henry Parkes regarded John Whitton as a "man of rigid and unswerving integrity". Further confirmation of Whitton's technical and administrative competence came from the findings of the Bridge Inquiry (1884-86) following charges that the lattice girder bridges had been poorly designed and constructed.

John Whitton was under constant pressure from successive Ministers of Works, there were 26 during his 35 year tenure of office, to change plans to suit political ends. Unfortunately he was only partly successful in resisting this interference. But his preference for initial high standards of planning and construction was vindicated in the 30 years after his retirement (1890-1920) when a great many deviations and upgrading of works were carried out.

John Whitton retired in May 1890 and died 8 years later in February 1898 in Mittagong, NSW. He is buried at St. Thomas Church of England Cemetery, Cammaray (not North Sydney). His career and service to the colony has earned him the distinctive title as "Father of the NSW Railways".

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# Australian Dictionary of Biography

Volume 6, 1851 - 1890, pp 393-394

WHITTON, JOHN (1820-1898), engineer, was born near Wakefield, Yorkshire, England, son of James Whitton, land agent, and his wife Elizabeth, née Billington. Articled for seven years to John Billington, of Wakefield, he gained engineering and architectural experience preparing plans and tenders for railway construction and waterworks. In 1847 he was engineer for the Manchester, Sheffield and Lincoln railway, and in 1852-

56 supervised the building of the Oxford, Worcester and Wolverhampton line. In 1854 he was elected a member of the Institution of Civil Engineers, London, and on 27 March 1856 was appointed engineer-in-chief at a salary of £1500 to lay out and superintend the construction of railways in New South Wales. With his wife Elizabeth, née Fowler, whom he had married about 1856 at Ecclesfield Church, Yorkshire, he arrived in Melbourne in the *Royal Charter* in December and reached Sydney on the fourteenth.

Whitton found in New South Wales 23 miles of 4 ft. 8½ ins. gauge railway, 4 locomotives, 12 passenger carriages and 40 trucks. In January 1857 before the Legislative Assembly select committee on the sole commissioner of railways incorporation bill, he vainly advocated conversion to the 5 ft. 3 ins. gauge adopted in Victoria and South Australia, and the extension of the railway from Redfern to Hyde Park in the city. He reorganized accounting and costing and took charge of the rolling stock, line maintenance and workshop departments. He resisted Governor Denison's proposal to construct 4000 miles of light, narrow-gauge tramways to be worked by horses and in the 1860s was constantly hampered by the government's uncritical acceptance of the lowest tenders for railway construction.

In April 1865 allegations of fraud were made against Whitton and his brother-in-law Sir John Fowler, an engineer and inspector of railway materials bought in England by the New South Wales government; the charges were proved groundless by W. C. Mayne [q.v.], agent-general for New South Wales. The 1870 select committee on railway extension chaired by (Sir) William Macleay [q.v.] recommended the construction of cheap narrow-gauge railways, necessitating a break of gauge within the colony, as well as at the border; estimates were prepared but Whitton, determined to sabotage the committee's recommendation, suspended all surveys and new work.

With the aid of E. C. Cracknell [q.v.] he overcame the engineering problems, partly caused by the government's cheese-paring, in building the Blue Mountains line: it included two great zigzags and was opened on 4 April 1876. In 1880-85 the unprecedented growth in railways, one thousand miles of new track and nine million more passengers, exposed existing inadequacies in administration and exacerbated the friction between Whitton and Commissioner C. A. Goodchap [q.v.]. The 1884 royal commission into railway bridges exonerated Whitton of the charges of faulty design and of using inferior materials. In 1888 Sir Henry Parkes's [q.v.] Government Railways Act reorganized the department and Goodchap's subsequent resignation made Whitton's position easier.

In 1886 and 1887 he had submitted drawings for a proposed suspension bridge across Sydney Harbour from Dawes Battery to Milson's Point. On 1 May 1889 the Hawkesbury River bridge was opened; it was the final link in the railway system from Brisbane through Sydney to Melbourne and Adelaide and Whitton had fought for adequate finance for it. He was a member of the Hunter River floods commission 1869-70, the Sydney, City and Suburban Sewage and Health Board 1875-77, and the Board for Opening Tenders for Public Works 1875-87; he was a New South Wales commissioner for the Melbourne International Exhibition in 1880.

Granted a years leave on 29 May 1889, Whitton retired on 31 May 1890 with a pension of £675, and visited England in 1892. He had supervised the laying of 2171 miles of track on which no accident had occurred attributable to defective design or construction. Parkes regarded him as 'a man of such rigid and unswerving integrity, a man of such vast grasp, that however his faults may occasionally project themselves into prominence, it would be difficult to replace him by a man of equal qualifications'. Survived by his wife, one son and two daughters, he died of cardiac disease on 20 February 1898 at Mittagong, and was buried in the cemetery of St Thomas's Church of England, North Sydney. His estate was valued for probate at £10,396.

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THE MAINE DISASTER.

PUBLIC FUNERAL AT HAVANA

SPANISH EFFUSIVENESS IRRITATING THE AMERICANS.

LONDON, Feb. 18.

The victims of the terrible explosion on board the United States cruiser Maine were accorded a public funeral at Havana. There was an impressive military display. The theatres in Havana were closed, and the newspapers were published with mourning borders.

It is suggested that the disaster was caused by the explosion of one of the mines in Havana harbour.

The effusive sympathy shown by the Spaniards in connection with the calamity is irritating the Americans.

The United States Congress has voted 200,000dol. for the work of recovering the bodies, and also for the operations in attempting to raise the Maine.

TELEGRAM OF SYMPATHY FROM AUSTRALIA.

PRESIDENT MCINLEY'S REPLY.

MELBOURNE, Sunday

When the news of the terrible disaster to the Maine reached Melbourne on Thursday the Premier attending the Federal Convention had a consultation as to the advisableness of sending to the Government and the people of the United States a message of sympathy, and Mr. Reid, on their behalf, telegraphed as follows to the President of the United States: "Parliament House, Melbourne, February 17, 1898.—The Premier of New South Wales, Victoria, South Australia, Tasmania, and Western Australia, attending the Federal Convention at Melbourne, have just received intelligence of the total destruction of the United States ship of war Maine, and of the death of many of her crew in the harbour of Havana. They desire to convey through you to the American nation, and especially to the relatives of those stricken down by the sad calamity, the earnest and sincere condolences and sympathy of the people of their colonies. By request G. H. Reid, Premier of New South Wales."

To-night the following reply was received by Mr. Reid:—"Washington, D.C., February 17, 1898. Right Hon. G. H. Reid, Melbourne. The President of the United States directs grateful acknowledgment of the touching condolences of the Australian Premiers. In the presence of such overwhelming sorrow, sympathy like this from our kindred beyond the seas touches the American heart very deeply."

W. R. Day, Acting-Secretary of State.

THE IMPERIAL PARLIAMENT.

THE ADDRESS IN REPLY ADOPTED.

LONDON, Feb. 19.

In the House of Commons last night an amendment to the Address in Reply to the Speech from the Throne condemning the severity of the law dealing with sedition in India was rejected.

The Address in Reply was adopted.

THE GERMAN AND FRENCH ARMIES.

QUICK-FIRING GUNS.

LONDON, Feb. 18.

The Emperor William has informed the German military attaches in Berlin that the German army is almost supplied with Krupp's new artillery, capable of throwing 12 shells per minute.

France is constructing 5000 equally rapid-firing guns at a cost of £10,000,000; but at present only 1000 are ready for use.

DEATH OF MR. JOHN WHITTON.

THE FATHER OF NEW SOUTH WALES RAILWAYS.

Yesterday intelligence was received of the death of Mr. John Whitton, at Mittagong, at the age of 79. Mr. Whitton left Sydney on Thursday last, although then unwell, for Mittagong, and on Friday he was so ill that his medical adviser was sent for from Sydney. To the surprise of the Railway Commissioners an intimation was sent on Friday last that he was slightly better, but yesterday news received by Mr. McLachlan, Secretary for Railways, that he had passed away. The Railway Commissioners were naturally concerned at Mr. Whitton's death, as he was a man who was held by them in the very highest esteem. His death removes another of the great chiefs who have been instrumental in founding and building up the railway system of New South Wales, he being the third within a comparatively short time to pass away. First came the death of Mr. Goodchap, then followed the late Chief Commissioner, Mr. Eddy, and now Mr. Whitton has gone over to the majority.

Mr. John Whitton was born at Wakefield, Yorkshire, in 1818. After many years' experience on the English railways he was appointed, on the recommendation of the President of the Board of Trade, Engineer-in-Chief of the New South Wales railways in March, 1852, and subsequently had sole charge of the construction of railways, and also of all surveys, in the colony; and for many years he was also in charge of the locomotive and permanent way branches. In 1890 Mr. Whitton retired, and was allotted a special pension in view of his lengthened and exceptional services. The amount was, however, considerably reduced by the Assembly in account of its unpopularity, which, it was feared, might give rise to similar claims in the case of other officers in the future.

Although he was not associated with the existing lines after the present Commissioners were appointed, they had a great deal to do with Mr. Whitton soon after the appointment of the present board, and the late Chief Commissioner, Mr. Eddy, and Mr. Whitton were close friends. Mr. Eddy, shortly after his appointment, seeking Mr. Whitton's advice on many occasions. Mr. Whitton was held in very high respect throughout the railway service, more particularly amongst those who had been associated with him, and though he was a man who never sought for popularity the evidence of his kindly disposition was shown in the esteem in which he was held by those who were subordinate to and most closely associated with him. The colony has a great deal to thank Mr. Whitton for in having the basis of sound lines of the railways of New South Wales. He was connected with them from their initiation, and had many a hard fight to carry out his ideas in regard to standard gauge lines. He was always looked upon as very conservative, but his conservatism, in the opinion of leading railway officers, was one of the best things that could have happened in the early days of a number of wild ideas prevalent as to the kind of lines that should be made, and he had notably to fight great opposition in regard to the break of gauge, a strong agitation having at one time set in for a break of gauge at Goulburn and Bathurst, and the construction of light narrow-gauge railways or horse tramways from those points. Mr. Whitton was wise enough to look ahead and foresee the great business that the trunk line would eventually carry, and in spite of all opposition he was successful in having all the main lines laid to the standard gauge, and in substantially the way they exist to-day. It is difficult to judge accurately of his methods; but those best able to form an opinion say that in view of the times and the peculiar difficulties in regard to labour in the colony at the time his system of construction was undoubtedly the best, even though it has been found necessary by the Railway Commissioners in later days to make certain improvements in regard to the running ways.

He was a man of the strictest integrity and of great firmness of character, and he successfully resisted all political pressure, insisting on controlling the lines in what he deemed the best way, even though his opinion clashed with that of the Government of the day. An instance of his firmness is related by one of the railway officers in regard to the appointment of two construction officers. The Minister controlling his department in a minute directed the appointment of two officers, and even fixed their salaries and duties. On the minute going before Mr. Whitton, who was then Engineer-in-Chief, he promptly informed the Minister that he declined to carry out the instructions, as he considered the men whom the Minister wished to appoint were not required. On the matter coming before the Government Mr. Whitton's action was upheld. This is an instance of resistance of political influence at a time when it might have wrought much harm, and this resistance is one of the causes which assisted materially in the successful management and operation of the New South Wales railways even before the appointment of the present non-political board.

TO-DAY.

Waverley Wesleyan Church: Public Meeting, 7.30 p.m.  
Professional Orchestral Band Association: Concert, 8.15 p.m., 514 George-street, 2.30 p.m.  
Tailors: Meeting, Trades Hall, Dixon-street, 8 p.m.  
Mourning, B.B.P. 543: Doctores A. I. 7.30 p.m.  
Brighton Racquet Club: Dinner and Golfing Meeting, 7 p.m.

when he was head of his... The colony was... at the early stage... a man of... training and great... independence, and... notice of Mr. Whitton... in another column, there... of his characteristic... especially in opposing... for break of gauge at... Bathurst. At that time... of railway construction... did suffice to stop the... points on the Southern... and, continue con-... system of light railways... stood these agitations... any its uniform gauge, a... bably involved more direct... to the community than... During the many years... before Parliament... of Public Works examined... always, and before the... ment was safeguarded as... Mr. Whitton had a... bility of the most serious... that we have so long... the railways which he... tary direction, surveyed... cannot be denied that a... the gratitude is due for... his administration... probably were in that... as were all but inevi-... tence, neglect, or any... were none. Mr. Whitton... more than now a per-... department was subject to... teritorial pressure main-... sidered the interests of... unity, and that must... him for no ordin-... he been other than... branch of the Public... controlled might have... and far less effective... sides this gain he set... integrity and courage in... of affairs—an example... in the case of a new... upon its railway era.

His Excellency the... day preside at the annual... Hospital, and on the same... the chair at the... the Carrington Hospital... afternoon he will... meeting of the Prince... Whitfield and Mr. Pon-... Government House. Cap-... to Sydney. Captain... on Saturday to pay a visit at... Park, whence he returns

tion of Bathurst Gaol.—... Minister for Justice, Mr. A. J. Bathurst Gaol, and made a... the establishment in com-... mander-General of Prisons... Alterations and addition... mplementation in consequence... of certain changes in the class... The site of these altera-... was examined. No warning... Minister to inspect the... and Mr. Gould says that it... find everything in, such

THE FEDERAL CONVENTION.—... been made for Mr. Brunker... Convention in Melbourne... ning.

DEATH OF THE INSANE.—... Public Service Board has... tment of Dr. Eric Sinclair... Manning in the post of... the Insane. The appoint-... the approval of the... Dr. Sinclair is the medical... Hospital for the Insane at... at he was appointed on

—The Electric tramway... proved so successful that... sometimes find it difficult... especially on holidays... have been urged to... of the line. The... extensions will probably... ing, and in view of this

of 65 tons, laden with... reached port yesterday... Captain J. M. Banks on Saturday night left here... on the steamer Mermaid to bring the vessel to... Sydney, she having lost her rudder and been other-... wise damaged. The Hilda was taken out by the... Mermaid, and subsequently in tow of the tug... Newburg, the Mermaid acting astern as a steering... boat. Good speed was made along the coast with... the Hilda, the craft being eventually berthed at... the Central Wharf at noon yesterday. In... consequence of the wreck of the steamer... Mataura in Magellan Straits the directors of the... New Zealand Shipping Company have decided to... send the Ruahine and Rimutaka round the Horn... instead of taking the Straits route. It is stated... that the companies have increased the insurance... rate of premium on the Magellan route. The... New Zealand steamer Stormbird narrowly... escaped foundering off the coast the other day... She had been ashore and put into Waunganui... for temporary repairs, leaving there with steam... pumps going. These it was found could not keep... her afloat, and the waters gained so that it put... the fires out. Assistance was sent from Wellin-... ton, at which port the Stormbird has since... arrived. On the run across to Wellington of the... mail steamer Aorangi the other day she was... delayed 12 hours owing to an accident to her... machinery.

A MISCELLANEOUS CARGO.—The Gulf Line... steamer Gulf of Venice, despatched by Messrs. A. M. Arthur and Co. on Saturday to London and... Manchester, took a very assorted cargo. In the... frozen meat line there were upwards of 28,500... carcasses of mutton, 2000 bales of wool, over 7000... bales of lead, and by way of variety two lions and... two tigers.

THE CALEDONIAN'S PASSENGERS.—On Saturday... morning three of the passengers by the Caledo-... nian were released from the quarantine station. The... names are Messrs. G. A. Stockfield, Motson, and... G. H. Dennis. The last-named is the pilot who... was taken on board at Melbourne.

THE RETURN OF MR. G. S. YUILL.—The s.s. Orinda, which arrived in Sydney on Saturday, brought with her the usual complement of re-... turning colonists and casual visitors from other... parts of the world. Foremost in point of interest... to Australians was, of course, Madame Albani. Among other passengers perhaps the best... known here was Mr. G. S. Yuill, of the shipping firm of Yuill and Co., Bridge-street. He left Sydney in April last, and consequently... has been absent about 10 months. Speaking of the... business objects of his visit, Mr. Yuill stated that he had purchased two vessels which were at... present being employed in trade along the Aus-... tralian coast. He was in England during the... time of the engineers' strike, and remarked on the... extent to which that industrial dispute had upset... the equilibrium of the shipping and commercial... world. He is confident that now the dispute is... over there will be a period of abnormal activity in... shipping circles. As a produce merchant carrying... on business with England Mr. Yuill was naturally... interested in everything connected with the distribution of Australian produce in the English markets. He thinks that the chief drawback with which colonial mer-... chants have had to contend hitherto has been the... somewhat inadequate appliances used on board... home-going vessels. Speaking of commercial... matters, he was struck by the extent to which... German competition is affecting the English... manufacturers.

QUEENSLAND GOLD.—The steamer Cintra, which... late last night arrived with a large number of... passengers on board, had as part cargo a shipment... of 5000oz gold.

CONDEMNED FRUIT.—On Saturday morning a... further quantity of fruit was condemned by the... inspectors of the Agricultural Department, under... the newly issued regulations of the Vegetation... Diseases Act. The fruit condemned consisted of... 60 cases of pears and 35 cases of lemons brought... over from New Zealand by the steamer Wakatipu. The lemons, it is stated, were originally shipped... from this colony to New Zealand, but they were... condemned in New Zealand, and were then... brought back to Sydney. Fruit condemned by the... Department is not allowed to be landed in New... South Wales.

DROWNED NEAR CIRCULAR QUAY.—A coal-... jumper named David Powell fell into the water... near the ship Barbarossa at Circular Quay early... on Saturday morning. When his body was re-... covered it was found that life was extinct. At... the inquiry concerning his death subsequently... held at the Lloyd Hotel, George-street, by the... City Coroner, it was elicited that deceased was... under the influence of liquor when he got into the... water. A finding of accidental death was... recorded.

A FATAL FALL.—On Saturday afternoon Wm. Vincent, 11, lately residing with his mother, a... widow, in Victoria-street, Paddington, was re-... turning home from Double Bay in company with... other boys, but when near Point Piper-road Vin-... cent fell into a quarry a distance of about 50ft.,... and was killed instantaneously.



# John Whitton.

Death has of late been somewhat busy with the great men who have taken a leading part in building up and managing the railway system of New South Wales. Within a comparatively short period the three most conspicuous names in connection with the history of the service have disappeared. It seemed but the other day almost that the colony sustained the loss of Mr. Eddy, and Mr. Eddy's death had followed somewhat hard upon that of his retired predecessor, Mr. Goodshap. Now comes the announcement of the demise of Mr. John Whitton, a man whose name deserves to be honorably and gratefully remembered for the substantial service he rendered the colony during an unusually long career in a high and responsible office. It is now nearly eight years since the late Engineer-in-Chief retired, yet his name has remained as familiar as a household word both in the railway service and outside it. He had been at the head of the construction branch for nearly forty years, and was responsible for the work of laying down the whole of the lines up to the time of his retirement. He took charge of his branch in the very year that Responsible Government was inaugurated, and at that time railway construction as well as railway management, if not exactly in their infancy, had not reached a very advanced stage. With the policy of constructing the various lines, of course, the then Engineer-in-Chief, as now, had ostensibly nothing to do; but there was no such body in existence in his day as the Public Works Committee. The responsibility of recommending railway lines to Parliament rested solely with Ministers, and as Ministers were dependent largely upon the reports of their officers, who were under the immediate control of the Engineer-in-Chief, the occupant of that office doubtless had some voice in determining the railway policy of the country, though it could have counted for comparatively little as against the influence of the politicians on whom lay the responsibility of determining the fate of the various proposals, and who really shaped the railway policy of the country. What Mr. Whitton did was to see that the lines ordered to be constructed were well and faithfully laid down. His responsibility was, of course, a heavy one, but he was fully equal to it, and his vigorous understanding and sound judgment secured the colony against the adoption of a shortsighted policy in railway construction. Against considerable commercial, professional, and political influence he succeeded in prevailing upon the Governments of the day and the Legislature to lay secure the foundations of future railway extension. But for him a system of light narrow gauge branch lines, cheap at the time, would have been adopted, which would have entailed enormous cost in subsequent years. He was accused of having been extravagant, but he was more far-seeing than his critics. He foresaw the great future of railway construction in this country, and accordingly realised the paramount necessity of laying in a solid foundation. The difficulties he had to contend with were enormous, and all the greater because the colony's credit was, in the early stages, practically stopped, at any rate as far as railway construction was concerned, and the money difficulty was only got over by the early contractors, Messrs. Peto, Brassey, and Betts, taking our debentures in payment for the work. We paid dearly for our railway whistle, of course, but we got, all things considered, solid enduring work, thanks to Mr. Whitton. That he made no mistakes, no one will say. The great and costly Zig-zag, for instance, which was long looked upon as one of the railway engineering wonders of the world, might have been avoided; but the Blue Mountains had to be crossed somehow, and that appeared the best means at the time. Mr. Whitton was a man of dauntless courage and irreproachable character. He served New South Wales faithfully and well, and New South Wales cannot be said to have been ungrateful. Mr. Whitton had enjoyed a liberal salary for many years—higher than that given to Ministers of the Crown—and retired on an equally liberal pension. His name will, besides, assuredly be held in grateful remembrance by the people to whose service he consecrated the best years of a useful life.

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MINUTES OF PROCEEDINGS  
OF  
THE INSTITUTION  
OF  
CIVIL ENGINEERS;

WITH OTHER  
SELECTED AND ABSTRACTED PAPERS.

VOL. CXXXII.

EDITED BY  
J. H. T. TUDSBERY, D.Sc., M. Inst. C.E., SECRETARY.

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JOHN WHITTON was born at Foulby, near Wakefield, Yorkshire, in 1819. In 1835 he was articled to Mr. William Billington, who designed and carried out the Wakefield Waterworks and other engineering undertakings. In the early days of railway enterprise he was busily engaged for several years assisting Mr. Billington in taking surveys and levels and in the preparation of Parliamentary plans, in connection not only with some important railway schemes but also with a proposed ship canal from Liverpool to Manchester, which he designed and of the surveys for which he had sole charge. About the year 1846 he was engaged under Sir John Hawkshaw<sup>1</sup> on Parliamentary surveys and on railway work in Lancashire. In 1848 and 1849 he acted as an Assistant Engineer on the construction of the East Lincolnshire Railways under Mr. (now Sir John) Fowler, and was subsequently engaged under that gentleman in completing the Oxford, Worcester and Wolverhampton Railway, and on railway construction in Yorkshire and elsewhere between 1851 and 1856.

Mr. Whitton's energies were now afforded a wider scope. In March, 1856, on the recommendation of the President of the Board of Trade, he was appointed Engineer-in-Chief of the New South Wales Government Railways. Subsequently he had sole charge of the construction of railways, and also of railway surveys, in that Colony; and for many years he was, in addition, responsible for the locomotive and permanent way departments. The colony was fortunate in having at the early stage of railway construction a man of sound professional training and great rectitude of character, independence and foresight. In no instance did he render greater service than by opposing the agitation for break of gauge at Goulburn and Bathurst. At that time certain critics of railway construction thought it would suffice to stop the trunk lines at those points on the Southern and Western roads and continue construction on the system of light railways. Mr. Whitton withstood those representations and secured for the colony a uniform gauge, a service which probably involved more direct and indirect gain to the community than can now readily be realized. He was a man of the strictest integrity and of great firmness, and he successfully resisted political pressure, insisting on controlling the lines in what he deemed the best way, even though his opinion clashed with that of the Government of the day. On his arrival in Sydney in 1856 there were only 22 miles of

railways in existence in New South Wales. On his retirement in 1890 he left over 2,000 miles of lines opened for traffic. The mere mileage, however, does not convey an adequate conception of his work, for the construction of the first 500 or 600 miles of the New South Wales Railways, including, as they did, very heavy works on the Great Western line over the Blue Mountains and on the first portions of the Great Southern line, took many years to effect and cost as much as £70,000 to £80,000 per mile, of single line track.

Mr. Whitton died at Mittagong, near Sydney, on the 20th of February, 1898, at the age of 79. His connection with the Institution was one of nearly 44 years' standing, he having been elected a Member on the 2nd of May, 1854.

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<sup>1</sup> Minutes of Proceedings Inst. C.E., vol. cvi. p. 321.

## Mr. John Whitton, Engineer-in-Chief of Railways.

Among those public men of the colony who occupy professional positions, and who are not liable, like the political Ministers under whom they serve, to sudden removal, but fulfil, year after year, with all the advantages their experience can give them the same or higher yet similar functions in the service, none is more distinguished for ability than Mr. John Whitton, the Engineer-in-Chief of Railways, —none, it may be said, is equal in the grandeur of his achievements.

Mr. John Whitton was born at Wakefield, Yorkshire, in the year 1830. That county and the adjoining one, Lancashire, constitute the very metropolis of railway construction and engineering. And in early life Mr. Whitton devoted his attention to enterprise of this kind. He had many years' experience on English railways, and such was the reputation he acquired in the construction of lines, that when the Government of New South Wales sent home for the best man that could be had there, Mr. Whitton was recommended to them. He was then engineer of the Oxford, Worcester and Wolverhampton lines.

After due investigation, the Government of this colony appointed him Engineer-in-Chief of all the New South Wales railways. He received this appointment on 27th March, 1856. From that date he has had sole charge, with some slight exceptions, of the construction of all our N.S.W. lines. To him is due the credit of constructing all the lines in the colony, with the exception of the following:—Sydney to Liverpool, Richmond to Windsor, Newcastle to Maitland.

Mr. Whitton has displayed no small amount of firmness in resisting the more contracted views of Ministers, the blandishments of people who desired the railway to deviate, so as to touch their towns. He withstood all such attempts to interfere with his comprehensive project of carrying out trunk lines to the borders, and to the great producing districts of the interior.

Mr. Whitton had also to fight the battle of gauges. Foreseeing the great future of the colony, he insisted that a narrower gauge than the present 4 feet 8 inches would be injudicious. He maintained this view in opposition to a select com-

mittee, of which William Macleay was chairman, which recommended the construction of a cheap line on the common roads from Goulburn to Albury, and also the reduction of the gauge to three feet. Several Ministers of the Crown supported Mr. Macleay in these views. But Mr. Whitton withstood them, and events have proved that he was right.

To Mr. Whitton is due the praise for the construction of the Zig-zag at Lithgow Valley, which will hand his name down to posterity.

To Mr. Whitton credit is due for resisting the efforts of members of successive Governments on matters which he understood better than they did, and honestly performing his work, and faithfully reporting on the difficulties which would be met with on each proposed route. He has had much to contend with in being baulked by the influence of members of Parliament supporting the demand for the simultaneous construction of railways along several routes, members representing northern, southern, and western constituencies, each desiring his own line carried out.

During a long time members wasted years in discussion, and ultimately demanded the construction of the lines finally decided on in so many hours. Under the direction, with the above-mentioned comparatively small exceptions, of Mr. Whitton, there have been 550 miles of railway constructed and opened for traffic in New South Wales; and 208 miles are now in process of construction under his superintendence. This is enough to show that the material prosperity of the colony owes very much indeed to his labours.

Mr. Whitton has also written elaborate reports on the railway systems, reports which prove at once his great clearness of reasoning, and his force of character. He has had the satisfaction of seeing all his prognostications fulfilled, both as to the unfitness of plans which he condemned, and as to the soundness of his own construction.

John Whitton



## ZIG ZAG BUILDER

*The Freeman's Journal 4/2/1882 p15.*

### THE FREEMAN'S JOURNAL.

THE LATE HON. PATRICK HIGGINS,  
M.L.C.

The Honourable Patrick Higgins, M.L.C., died at  
Arlington, Edgecliff-road, Woollahra, on Saturday  
evening.

The Hon. Patrick Higgins was born in Sligo, Ireland, in the year 1825, his father being a farmer, and a tenant of Lord Palmerston. In 1852 the attention of Mr. Higgins was attracted to Australia by reason of the gold discoveries in Victoria, and at the end of that year he and his brother, Mr. John Higgins, landed in Melbourne. In Ireland the Messrs. Higgins carried on business as contractors, and immediately they arrived in Victoria they resumed their occupation, commencing with a contract for making a part of the Mount Alexander road, which led to the gold-fields of Kolor Plains. Subsequently, in partnership with his brother, he became contractor for the construction of suburban railways in Melbourne, and also undertook the making of a portion of the railway between Melbourne and Echuca. Being to some extent disposed to speculate, Mr. Patrick Higgins entered into pastoral pursuits both in Victoria and New South Wales, in conjunction with the late Mr. Hugh Glass. Later on, having tendered for the construction of the Lithgow Valley Zigzag, and the portion of the railway line from the Zigzag to Wallerawang, on the Great Western Railway in New South Wales, and having succeeded in obtaining the contract, he came to reside in this colony. Out of this railway contract it was pretty generally believed that he made a large sum of money. He married, in 1855, a daughter of Mr. John Lynch, of Sligo. His wife, however, died the following year in giving birth to a son. Mr. Higgins left Sydney in 1873, with the object of visiting England, taking with him his son, for the purpose of having his education completed in the mother country; but on the way to Melbourne the boy disappeared in a mysterious way, and was believed to have fallen overboard.

Mr. Higgins went to England, and spent three years in visiting various parts of Europe. When he returned to the colony, in 1876, he entered actively, with other gentlemen with whom he had been previously associated, into the development of the Lithgow Viney Colliery Company. Mr. Higgins was also associated with the Sydney Omnibus Company, the Port Jackson Steamboat Co., and the Pyrmont Bridge Co., and was a director of the Intercolonial Insurance Company. He was a magistrate of New South Wales and also of Victoria for many years, and in December, 1880, was summoned to the Legislative Council of this colony. His principal characteristics were his clear-headedness, firmness, and indomitable perseverance as a man of business, combined with a spirit of enterprise, force of character, and determination of will which admitted of no possible failure in any undertaking to which he committed himself. Genial in feeling, benevolent in disposition, never bearing a tale of distress without doing his utmost, unostentatiously and unobtrusively, to relieve the sufferer, Mr. Higgins will long be remembered by those who had need of his aid, and by many friends who, we are sure, will join us in the expression of regret at his loss. He was a perfect specimen of a fine old Irish gentleman, and his death will cause a void not easily filled. His loss, especially at the present moment, when the colony stands in need of the services of men of his stamp, cannot be regarded as anything less than a national misfortune.



*The developing Great Zig Zag showing the top road beyond the viaduct before the signal was installed there and only one track on the bottom road.*

*The lower picture shows the mountainside before trees and shrubs had grown on the filled areas and only the single track on the lower road.*

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## Edward Charles Cracknell, Esq.

Mr. Cracknell, Superintendent of Telegraphs for New South Wales, was born at Rochester, county Kent, England, in 1831. He was educated at Oxford, and remained in that city until he attained the age of 17 years, when he went to London, and devoted himself to scientific pursuits. In November, 1855, he landed in Adelaide for the purpose of filling the responsible position of assistant Superintendent of Telegraphs, for the Government of South Australia. In that capacity he manifested ample evidence of a thorough knowledge of the profession, and of unusual zeal in the public service. These attainments, with other excellent qualifications gained for him an international reputation.

In 1857 he was invited by the Government of New South Wales to accept the office of Assistant Superintendent of Telegraphs, under the commissioner for Internal Communication—Captain Martindale. Mr. Cracknell accepted the appointment, and his services date from the 1st of January, 1858, so that on the 31st proximo he will have completed the cycle of twenty-one years in our Civil service.

On the arrival of Mr. Cracknell it might be said that telegraphy was in its infancy in Australia. It was on the seventieth anniversary day of the foundation of the colony, 26th January, 1858, that the first telegraph line was opened to the public from Sydney to Liverpool, a distance of 22 miles. Since then a complete network of telegraph has grown up, which connect all the townships of importance throughout the land. At the end of the year 1877, there were 9762 miles of telegraph wires in New South Wales—now the distance exceeds 10,000 miles, and equal to half the total extent of wires in all the colonies of Australasia. At the close of 1877 the wires of New South Wales connected 190 stations, and the number of messages transmitted during that year was over a million, which yielded a revenue of £87,253. In the same twelve months there were 1768 foreign telegrams, which produced an income of £22,017. There were 3941 cable messages transmitted to New Zealand, at a cost of £3129. This income, added to £1608 for intercolonial balances, gives a total revenue for the last year of £95,401, for which 1,001,884 messages were transmitted. The magnitude of this business, judging from the increase of past years, bids fair to be doubled at a date not far distant.

All these lines have been constructed under the direction of Mr. Cracknell, and it is well known they are of a substantial and satisfactory character.

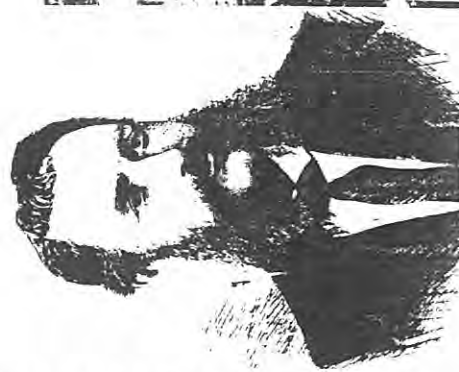
more particularly the iron pole lines, along the railways. These are light and strong, and unlike those of wooden material, not liable to be destroyed by fire. There is also another feature in Mr. Cracknell's superintendence of our telegraph system. With commendable forethought, he appears to have had always one very important point in view—that is, the duplication of all land lines. Now, in the event of interruption on one line, another is always available. This is clearly defined by a glance at the telegraph chart of the colony, where it will be observed that there is scarcely a town that cannot be communicated with under ordinary circumstances.

During the twenty-one years in which Mr. Cracknell has devoted his energies to the telegraph service of this colony, he has on two occasions visited Europe and America. On both occasions he made himself acquainted with the latest improvements in telegraphy, and has brought out samples of fast printing instruments. He also introduced the duplex and quadruplex systems. By these means the marvellous feat of transmitting two, and even four messages simultaneously over one wire, in contrary directions, is accomplished. These instruments are capable of working over from 500 to 1000 miles circuit at a speed working up to 120 words a minute.

When in England in 1876, Mr. Cracknell was presented with a *carte blanche* by the Secretary of State for War, and the Lords of the Admiralty to examine and make himself thoroughly conversant with the latest details in connection with torpedo warfare. He visited the torpedo depots at Woolwich, Chatham, and Portsmouth. At the latter place he witnessed a great many interesting and instructive experiments, which he was not slow to turn to profitable account for the colonial Government. Since his return, he has prepared a complete system of torpedo defence at Port Jackson, Newcastle, and Botany Bay. His designs and execution in this direction gained the approbation of the Government, as they might well do, upon the recommendation of such military authorities as his Excellency Sir William Jervois, K.C.B., and Colonel Scratchley, R.E. Mr. Cracknell has since been gazetted Major commanding the Torpedo Corps.

The colony is very much indebted to Major Cracknell for the introduction of all the latest improvements in electric science, more particularly the magneto-electric lights of Wilde and Siemens. The latter has been approved by the Trinity Board in London for light-house purposes. In addition to the position of Superintendent of Electric Telegraphs and major commanding the torpedo corps,

E. C. Cracknell

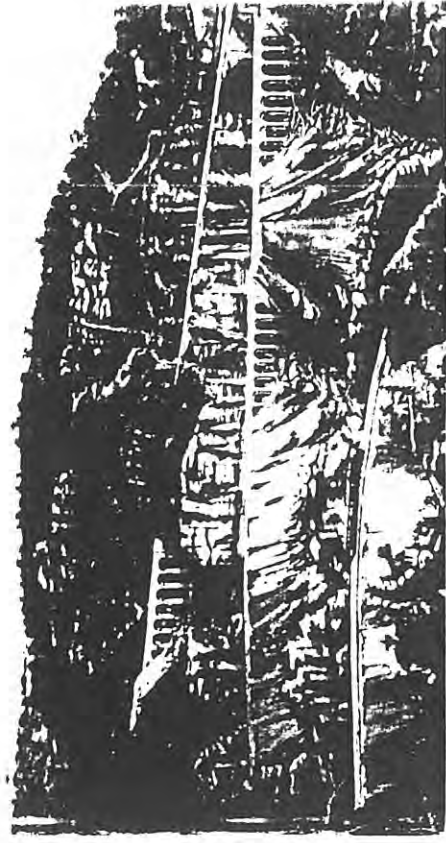




**AUTHORITATIVE HISTORICAL  
SUMMARIES**

# LITHGOW ZIG ZAG RAILWAY

Blue Mountains — New South Wales



William A. Bayley

FELLOW OF THE ROYAL AUSTRALIAN HISTORICAL SOCIETY

B4-3

## ZIG ZAG RAILWAYS INVENTED

THE zig zags for the Blue Mountains were designed by the renowned engineer of the New South Railways, John Whitton, who said at the enquiry in 1894 that when he designed them he had never seen any zig zag railways although he knew some existed in other parts of the world.

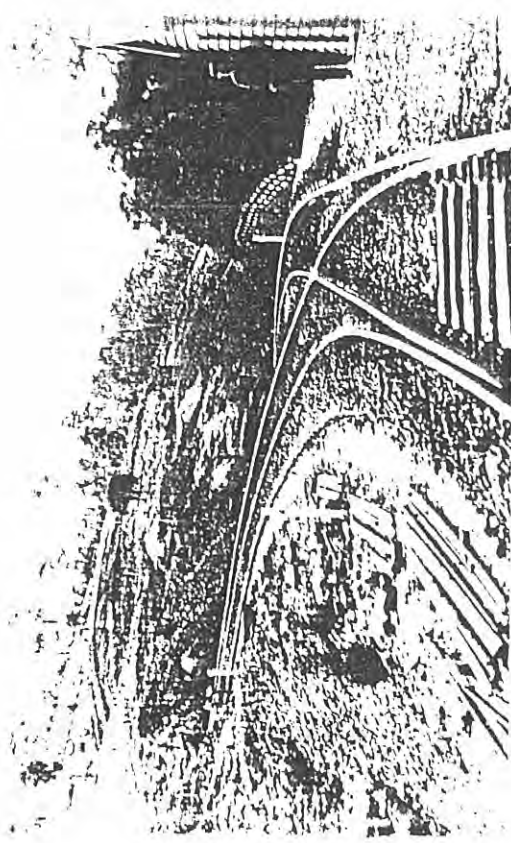
The Americans also called their zig zag railways switchbacks; the true zig zag railway having reversing points, whereas switchbacks sometimes allow a railway to criss-cross a mountainside but the ends of the roads sometimes enter spiral tunnels, or make a great horseshoe curve. Where only one change of direction was made in an area the term V-switch was used. The terms were used loosely but all zig zags eventually constructed in Australia had reversing points.

Probably the earliest zig zags were built in the 1840s in Pennsylvania for coal trains, whilst at Humesdale, Pennsylvania, and Ithaca, New York, zig zags carrying passenger and freight trains were early constructed and still in use in the twentieth century.

During construction of the Baltimore and Ohio Railroad to overcome the delay caused by completing the Kingwood tunnel the engineer, B.H. Latrobe, constructed a zig zag railway on a grade of 1 in 10 to the top of Pettibone Mountain in the Alleghenies and down the other side, a length of 2½ miles. The zig zag was opened on January 11, 1853. One engine could only draw two cars up the incline, the zig zag being abandoned after the opening of the tunnel.

Meanwhile in India plans for railway construction begun in 1843 were developed by survey from Bombay to Thana and Kalyan (34 miles) in 1850, construction to the former 5'6" gauge being begun in February 1852 using the first locomotive in India. The line to Thana was opened in 1853 and beyond to Kalyan the following year. At the latter the line forked north-easterly towards Calcutta and south-easterly towards Poona and Madras. The steep slopes of the Western Ghats, rising 2000 feet to the Deccan, proved a formidable obstacle and by the use of zig zag inclines and reversing stations, coupled with tunnels, bridges and viaducts the engineer, J.J. Berkley, constructed some of the most stupendous mainline track in the world at the time.

Earlier a mighty mountain railway — the first of its kind in the world — with viaducts, tunnels and inclines, was built through the Semmering Pass in Austria between Vienna and Trieste but zig zags were not used. Nor were they used on a similar railway constructed in Italy from Genoa up the Giovi Incline ascending the Apennines for



*Bottom Points, showing pointsman, on Lapstone Zig Zag.*  
—NEW SOUTH WALES GOVERNMENT RAILWAYS

295 feet, rising from the Mediterranean Sea. Those engineering feats gave a lead to later engineers.

The Indian railway reached Palasdhari on the line to Madras in 1856, sixty-three miles from Bombay, and Kasara on the line to Calcutta in 1861, eighty miles from Bombay. The former was halted by the Bhore Ghat and the latter by the Thal Ghat. Lines were built and opened on the Deccan from the tops of the Ghats, reaching well inland before the zig zags were completed. The line up the Bhore Ghat, thirteen miles long and rising 1831 feet on a grade of 1 in 37 was opened in May 1863 and that up the Thal Ghat ten miles long and rising 972 feet on a grade of 1 in 37 in 1865.

The opening of the line up the Bhore Ghat was reported in detail in the "Sydney Morning Herald" of July 3, 1863 whilst the same newspaper in January 1864 reported the proposal to build the line beyond Knapsack Gully in New South Wales as a zig zag, "a contrivance adopted on some of the American Railways in ascending steep inclines".

Surveys of the Blue Mountains in preparation for railway construction began in 1860 and the Lapstone Hill zig zag was planned before the opening of the first zig zag in India; that at Lithgow being planned soon afterwards.

## THE GREAT ZIG ZAG

SURVEYS for the railway over the Blue Mountains led the "Sydney Mail" in 1860 to report that the line would descend Mount York, where Cox's original road went down, by a spiral with a grade of 1 in 75 into the Hartley Valley.

That scheme was abandoned in favour of the line along the Darling Causeway, a ridge between the Grose and Hartley Valleys discovered and named by Hume in 1827. The line eventually reached the precipices, down which to carry the railway certain proposals were made. They began at Dargan's Creek near Newnes Junction of today and led to the narrow valley of the south-eastern tributary of Farmer's Creek.

The first was for a single line tunnel two miles long; defeated by inability to find an experienced contractor to build it; inability to secure ten million bricks for lining it or, if procurable, to cart them to the site; the four year time required and the exorbitant cost — at that time estimated at £400,000.

The only other alternative was to construct the zig zag railway outlined by John Whitton, using the precipitous sandstone curving mountainside above the creek for the descent.

The scheme involved not only the middle road of the zig zag with top and bottom roads about the same length but the railway from a spot some 1½ miles west of Bell to Eskbank some one mile west of a spot on the bottom road below the top reversing point from which the Lithgow Valley opened out from the narrow gorge.

That section was constructed by two different contractors. William Watkins' contract from near Mount Victoria took the earthworks beside Dargan's Creek gorge on a steep descending grade to cross the creek near its head; rising at 1 in 33 for 1½ miles to the tunnel at Clarence, 3658 feet above sea level.

After passing through the single track stone lined tunnel 1617 feet long on a 1 in 66 grade the line along a ridge fell on a grade of 1 in 42 for half a mile to make a half circle around Mount Sinai. The Clarence tunnel was at the head of the great zig zag and at Mount Sinai Watkins' contract ended, giving place to that of Patrick Higgins for the 15 mile section through Lithgow Valley and Bowenfels to Wallerawang including the zig zag.

The zig zag line was planned to descend along the slope of a small plateau, pass through a deep cutting, over a viaduct thence farther along the hillside to curve sharply; cross another curved viaduct and then run along a ledge to be cut out of the sandstone mountainside to reach the top reversing dead end separated by buffers from the precipice overlooking the valley.

After reversing, the trains were to follow the middle road sixty-seven chains long, first almost parallel with the top road through a cutting, along a straight viaduct followed shortly by a curved viaduct. Then the planned line drew farther away from the top road over another viaduct; through a curved tunnel, across an embankment and through a second short tunnel to converge with the upper end of the lower road on the floor of a narrow ravine, terminating at its head.

Reversing again the line curved sharply through a very deep cutting below and beside the first tunnel and followed around the contour of the mountainside with the creek parallel to and below it to curve finally westward to follow Farmer's Creek along a high embankment to what

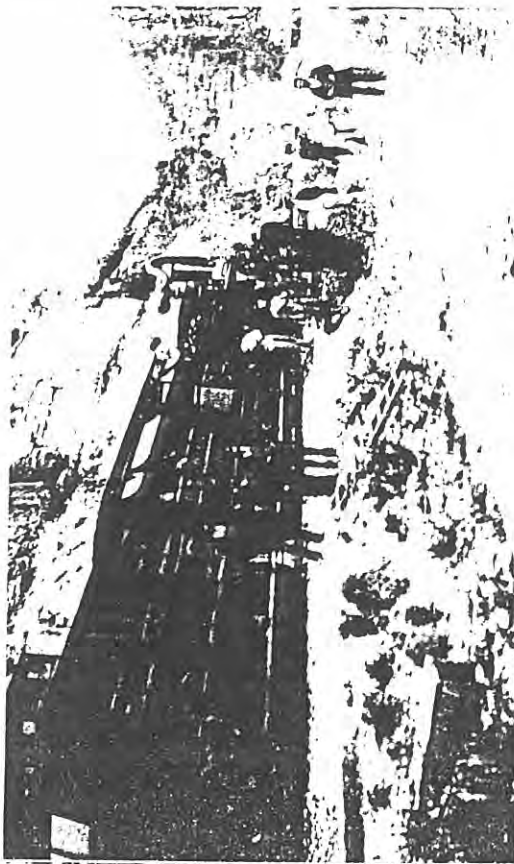


*The Great Zig Zag in 1873 before trees and scrub had grown on the embankments, showing single track on the lower road.*  
—MITCHELL LIBRARY

later became Eskbank. The line then ran along the valley to Bowenfels which was the only station after leaving Mount Victoria.

The grade was generally 1 in 42 down the zig zag with the dead ends at 1 in 66 rising against the train





*Tourist train at the "Water Crane" at the bottom points of the zig zag, about to ascend the middle road.*

—MITCHELL LIBRARY

passing down the mountain to assist it to stop. The curves were sharp with radius ten chains or sometimes eight chains, the sharpest used on the railways.

The whole zig zag was in plan like an elongated S, the line dropping 470 feet in 1½ miles, but, counting the switchback taking 3¼ miles of railway.

Construction work had not been long under way when the "Sydney Morning Herald" of January 7, 1867 and the "Sydney Mail" of January 12 described the work unique in the history of railway construction in New South Wales.

Massive removal of the rock face was planned to cut the railway track and throw the stone down the mountain-side in one operation.

In an experiment not before tried workmen drilled twenty-five triangular holes to a depth of thirty feet, having straight sides along the part to remain solid, pointing toward the rock to be blown away. Using 3½ tons of blasting powder, E.C. Cracknell, Superintendent of Posts and Telegraphs, was to direct the explosion with the aid

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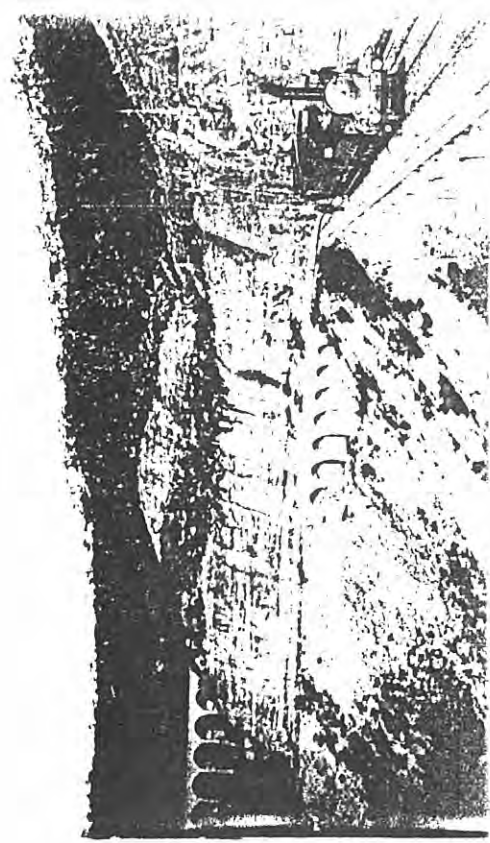
of electric batteries to form what became known as the first great blast at a public ceremony on Saturday, January 5, 1867 on the rock above and between the site of the viaducts subsequently built on the middle road.

Members of parliament, leading citizens of the colony and district, engineers, ladies and the 700 workmen attended on invitation to see at 1 p.m. the failure of the first attempt; the failure at 1.30 p.m. of the second attempt despite checking of the wiring and finally at 2 p.m. the rockface of 40,000 tons heaved down the mountainside.

Luncheon and speeches followed in the cool shelter of the already driven tunnel. Much more loosened rock fell later. During both survey and construction men were lowered down the cliff faces to do their work.

*Tourist train on the straight viaduct on the middle road of the Great Zig Zag in its early days.*

—MITCHELL LIBRARY



The colossal work said to have been with two or three exceptions without parallel in the world continued until after driving the second tunnel fissures in its roof showed instability, causing Whitton to decide to remove it. Three chambers with lengths 32 feet, 27 feet and 22 feet were cut in the rock inside the tunnel with drives at right angles filled with blasting powder.

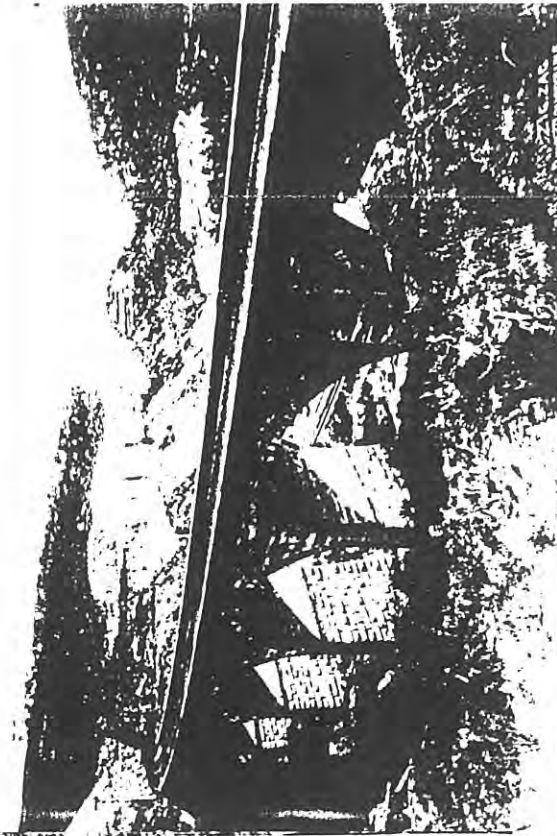
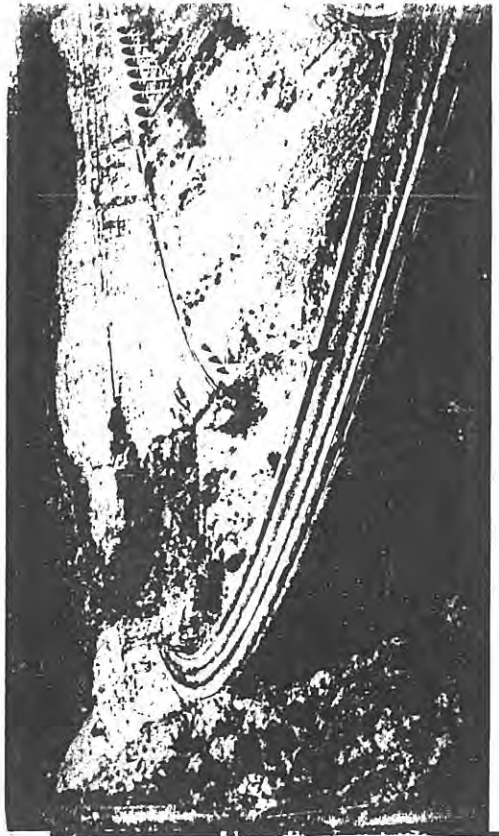
Another and greater ceremony was organised for the second blast when a special train from Sydney on Wednesday September 16 conveyed the Governor of New South Wales and the Countess of Belmore and party to Mount Victoria whence they travelled through Hartley Valley and up Farmer's Creek to reach the scene at 4 p.m. Luncheon was first served in a tent. Almost 1000 people from Sydney, Bowenfels and Bathurst were present to witness Lady Belmore turn a switch sending current from a battery of fifty-eight cells arranged by E.C. Cracknell to shatter 40,000 tons of rock in a great cloud of dust causing the tunnel to collapse and leaving the loose rock to be cleared away.

A sidelight to that ceremony records that the coach horses of the official party knocked up on the road up Mitchell's Pass compelling the ladies as well as gentlemen to walk up behind the coaches and delay arrival at Mount Victoria to find the train could not leave until 10 p.m. when the train bound for Mount Victoria reached there, having blocked the single line to traffic to Sydney which was reached at 2 a.m.

As work progressed further the "Sydney Morning Herald" of November 16, 1868 described it in detail. It pointed out that the first planned viaduct had been replaced by an embankment with a retaining wall of uncemented stones packed closely together. The remaining viaduct on the top road on a ten chain curve consisted of five 30 feet and two 15 feet arches. Commenting on the scenery the reporter wrote, "It is to be hoped that some photographer will be induced to take views from this spot." From that time photographers have continuously followed the advice, while artists, including the renowned Conrad Martens, have made the Great Zig Zag the subject of many paintings still extant.

From there the line passed through the solid rock cutting and along the rock ledge to the first reversing station. A shaft 120 feet deep had been used to shoot filling down to the lower level to build embankments.

On the middle road the higher viaduct was straight with nine arches each of thirty feet span, the highest being seventy-six feet, all stones having been let down the cliff face from above to be set in position. The lower viaduct of the two was curved on a ten chain radius and consisted of eight arches each of thirty feet span. The next planned



*The developing Great Zig Zag showing the top road before the signal was installed, with one road on the bottom, whilst the lower picture shows the signal and detail of the viaducts.*

viaduct which would have been erected below that on the top road was replaced by an embankment made of filling from the excavation at the top reversing station.

Then followed the tunnel, curved on an eight chain radius and lined with masonry of sandstone blocks. The line then crossed an embankment to what was to have been the second tunnel, leaving instead a cutting 110 feet deep and continued to the second reversing station, where on the hillside to the right at the head of the gorge a dam for watering the engines had been constructed.

On the lower level the line went around an eight chain curve in a cutting 120 feet deep to a ten chain reverse curve embankment around the gorge and finally an eight chain curve to round the mountainside and run out into the Lithgow Valley. The clear white grained stone for the viaducts was obtained from a quarry specially opened on the hill half a mile from the line.

Further descriptions appeared from time to time in Sydney newspapers prior to the opening and many people went by special train to Clarence and walked down the zig zag and back. One item in the "Sydney Mail" of October 2, 1869 mentioned the difficulties of signalling and suggested that guards use bugle calls!

At length the great masterpiece of engineering, three years in construction, was opened for traffic on Monday October 18, 1869, strangely enough without an official opening or ceremony of any kind. Trains from Sydney to Mount Victoria were merely extended to Bowenfels. No special trains were run; little notice was given in the newspapers and no arrangement was made for carriage of mails which were dropped off trains at Mount Victoria as previously. However travellers placed their horses and carriages on trains for conveyance between Bowenfels and Mount Victoria to avoid using them on the steep mountain roads until gradually the Blue Mountain road fell into little use until the motor car age dawned 50 years later.

## RENOWN OF THE ZIG ZAG

EVEN before the opening of the zig zag at Lithgow the Lapstone Zig Zag both for its engineering interest and its panoramic view of the Nepean River and coastal plains became a tourist attraction.

Groups and individuals made excursions from Sydney, some in special trains, to the top of Lapstone Hill where trains watered at the lagoon and returned. However the attraction of the Little Zig Zag soon gave place to the Great Zig Zag and within eight months of opening the passenger train time table was arranged to enable Sydney people to travel to Bottom Points and return to Sydney the same day.

Pointer to many historic visits was the tour in July 1870 of the commander and officers of the Russian frigate Boyarin on the invitation of the Minister for Works, accompanied by Railway and Public Works engineers. Breakfast was at Lapstone; refreshments were served at Blue Mountain (later Lawson) refreshment station and luncheon at the foot of the zig zag upon arrival at one o'clock where they saw "ice half an inch thick."

The "Australian Graphic" of May 11, 1889 reported that since the opening of the railway thousands of tourists had visited the zig zag and admired the skill of the engineers "probably not surpassed on any railway in the world."

As the years passed the claims were repeated and the great feat was kept before the notice of the people. With the opening of the Glenbrook tunnel in 1892 the "Sydney Mail" reported that the two zig zags had been the principal attraction of the western line and were looked upon as triumphs of mountain engineering, very creditable to the young colony at the time they were built. The fame of the zig zag remained while it continued part of the great western railway system.

*Panoramic view of trains on the Lithgow zig zag railway in 1904.*

—MELVIN VANINIAN (Mitchell Library)





## ZIG ZAGS IN OTHER LANDS

WHEREAS no zig zag railway now operates in Australia, the deviation of zig zags in other parts of the world has not always been possible, particularly in Peru.

In the years following the opening of the Lithgow zig zag railway the much higher and more rugged ranges in the Andes in Peru and Chile; the Rockies in America and the Himalayas in India challenged engineers. The necessity for the carriage of fertilizers and minerals in Peru; of merchandise coast to coast in North America and of tea in India brought the construction of railways in those inhospitable mountains.

The railway destined to zig zag to the highest point on a railway in the world was conceived by Henry Meiggs, renowned for engineering Andean railways, who began construction of what became known as the Central Railway of Peru in 1870 at Callao and through Lima using grades of 1 in 30 and 1 in 25, standard gauge, following the Rimac River Valley where he used a V-switch with engine turntable. His idea of zig zags was wrongly said at the time to be "absolutely new to engineering".

The line in thirty-four miles reached Chosica where the mountains begin then Cocachacra and then zig zagged to San Bartolome in 1871; took more zig zags with one single and three double V-switches to Chicla and up with seven more double V-switches to Saltacuna overlooking five layers of railway track beneath by 1878. Surveys were most difficult. In 138 miles between Callao and Oroya are sixty-one bridges, sixty-five tunnels, twenty-one V-switches and five zig zags.

Continued in 1890, it reached Casapaca in 1892 and Oroya in 1893 at seventy-nine miles from Lima, reaching a height of 15,865 feet above sea level. Its extension was called the Cerro de Pasco railway and it zig zagged down from the highest point reached.

Farther south the Peruvian Southern Railway begins at Mollendo and rises without zig zags to Pano reached in 1874; branching to Cuzco (built in sections up to 1907) and towards Santa Ana, two double zig zags taking the line up 1000 feet. Southward along the coast in Chile a short nitrate line from Tocopilla employs a double zig zag at Reverso on its way to the mines in the Andes.

The Trans-Andean railway from Buenos Aires in Argentina to Valparaiso was built to 5'6" gauge from the former, reaching Mendoza in 1887. It was 1910 before the line finally linked with Valparaiso in Chile. From Valparaiso to Los Andes the gauge is also 5'6", the lines being linked by metre gauge over the summit gained west of Mendoza by a "Meiggs V-switch." The greater part of the

western half of the metre gauge track is a rack railway on which, on the Chilean side, the "line describes a remarkable zig zag course."

There is mention of a switchback on the Leopoldina railway in Brazil linking Rio de Janeiro with Espirito Santo.

In the Himalayas the metre gauge railway reached Siliguri in 1878 after which the Darjeeling Steam Tramway Company began building a two feet gauge railway rising from 533 feet to 7,409 feet and down to Darjeeling at 6,812 feet in fifty-one miles with a ruling gradient of 1 in 25. Four loops and four "Z-type reverses" were included. The Indian government purchased the two feet gauge in 1948 and converted the loop above Rangtong to a "Z-type reverse." Zig zags operated by steam haulage continue in use there.

In the United States a temporary switchback 5½ miles long, having two reversing stations on either side of the summit was built over the Raton Mountains south of Trinidad, Colorado, in 1878 whilst the tunnel was being driven on the Atchison, Topeka and Santa Fe Railroad linking to New Mexico. It had a maximum grade of 1 in 16 but was only in use about one year after which the tunnel was completed.

Switchbacks used by the Great Northern Railway in 1892 enabled trains to climb the Cascade Mountains inland from Seattle in the State of Washington on the Pacific Coast in the north-west corner. Two locomotives operated on one end and one on the other until in 1900 the zig zags were eliminated by a 2½ mile tunnel superseded in 1929 by a tunnel almost eight miles long — longest in the Western Hemisphere.

In the new century the Sante Fe Railway in Arizona State used a zig zag with ten switchbacks to gain 2,000 feet on a grade of 1 in 25 in 1904 to complete the extension of a branch line from Prescott to Crown King. The zig zag lay between Middleton and Crown King but the line was abandoned by 1926 as the mines proved unprofitable.

The Canadian Pacific Railway in 1908 eased the heavy grade laid on opening the line in 1885 in the Kicking Horse Pass in the Rocky Mountains by doubling the length of line from four to eight miles and inserting a switchback railway. However reversing points were not used, trains changing direction by spiral tunnels at each end of the middle road.

Meanwhile the zig zag railways up the Bhore and Thal Ghats in India continued in use and remained a serious obstacle to railway operation. However all reversing stations have now been eliminated by the use of tunnels and deviations whilst electrification has facilitated movement of traffic, the line to Poona being electrified in 1929.



## OTHER ZIG ZAGS

Zig zags are one method of carrying railways up steeply rising mountains ranges. Although Europe has examples of these conditions, particularly in and around Switzerland, the preferred methods of ascent for main lines have been the more expensive tunnels, loops and spirals because European countries could afford high standards of construction. But in other countries of the world, particularly the colonial parts of the various European empires, funds were restricted and construction standards had to be lowered, consequently zig zags became an economically viable option.

According to the GUINNESS BOOK OF RAIL FACTS AND FEATS (John Marshall 1971), p73, zig zags originated in India on the Great Peninsula Railway and many are still in use in that country and in nearby Burma but no specific details are given.

But in 1935 a serial magazine called RAILWAY WONDERS OF THE WORLD edited by C. Winchester, has an article on Hill Lines in India and Burma, p826 - 833. In the article are details of the following zig zags, the 1925 line to the Khyber Pass has 1 zig zag; in Burma near Sedaw there are 3 zig zags; and on the Lashio Branch constructed during 1914-18 there are 4 reversing stations and 2 zig zags.

However, the most spectacular use of zig zags appears to be in Peru where 21 of them were incorporated on the Central Peru Railway during its 23 years of construction, 1870 - 93, ref:- GUINNESS BOOK OF RAIL FACTS AND FEATS, and RAILWAY WONDERS OF THE WORLD series.

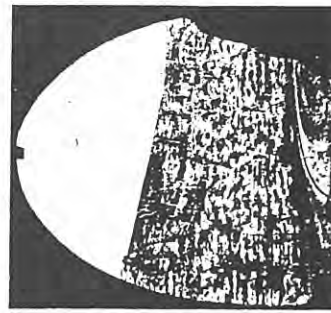
But in all these cases the zig zag is very long, often with some miles of track between reversing points. They are not as compact as at Lithgow where the whole system is visible, particularly the spectacular descent of the middle road. "The Great Zig Zag at Lithgow for years stood as a striking monument to the ingenuity responsible for the work, for it is even more daring than Meigg's famous V-switches on the Central Railway, Peru" - RAILWAY CONQUEST OF THE WORLD by F. A. Talbot 1911.

The Lithgow Zig Zag is one of earliest constructed in the world and is still in excellent condition hence the re-establishment of rail traffic on it. It has become a MUST for international visitors interested in railways as verified by Nick Piggot, Editor of the internationally distributed magazine "Steam Railway" (UK).

## ZIG ZAG RAILWAYS IN AUSTRALIA

WHEREAS the necessity for general railway construction brought the Lithgow zig zag railway, the transport of hardwood timber for which Western Australia became famous brought the zig zag railways to the Darling Range on the western side of the continent.

The sixties and seventies saw jarrah being brought down the Darling Ranges for railway sleepers and heavy construction work. Timber getters pressed farther inland and when Edward E. V. Keane, railway engineer and contractor, took over a timber licence granted on January 1, 1883 for the top of the range in 1891 he secured from the government the passing of an Act on February 26, 1891 to permit him to build the Upper Darling Range Railway.



*Drivers' eye view from the tunnel on the middle road at Lithgow, looking towards Top Points (left) and towards Bottom Points (right).*

—O. B. BOLTON

It branched from the 3'6" gauge Great Eastern Railway at Midland, forty-four feet above sea level and ran into the foothills to Statham's Siding at Ridge Hill, 362 feet above sea level and fifteen miles from Perth. From there to Gooseberry Hill it rose 458 feet in 3½ miles of railway, a grade of 1 in 40, to a height of 799 feet at 18¼ miles by a zig zag with four reversing points.

It zigzagged around a quarry and along the surface of the escarpment called The Knoll. From Gooseberry Hill it continued a mile to Kalamunda and to Canning Timber Station some twenty-nine miles from Perth.

The railroad carried passengers and goods and was sold to Millar's Karri and Jarrah Co. (1902) Ltd. on December 31, 1901. On July 1, 1903 the Western Australian Government Railways purchased the seventeen mile track from Midland Junction to Pickering Junction and officially

opened it on July 2. The train returning from the ceremony was delayed by the derailment of one carriage on the lower road of the zig zag. The three miles from Kalamunda to Canning Mill was bought in 1910 and in 1911 an extension over 1½ miles was built and officially opened in 1912 to Karragullen.

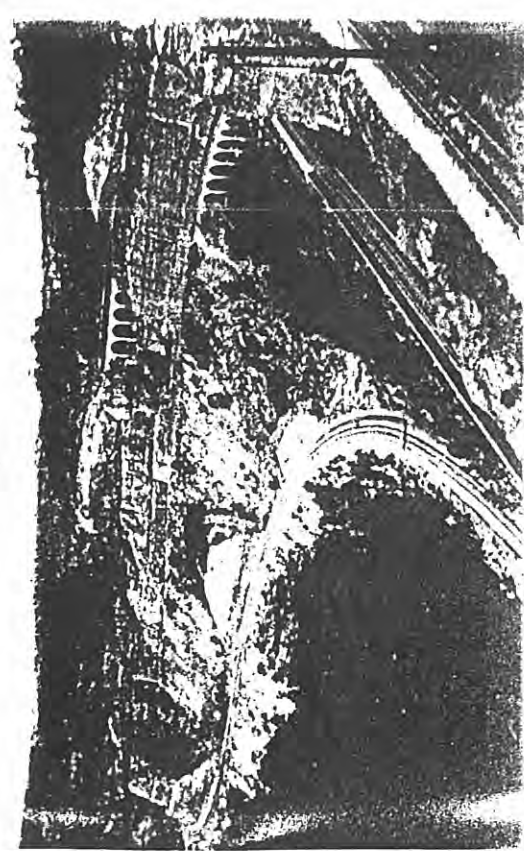
The last regular train for passengers and goods ran on July 22, 1949, ceasing running because of coal shortage due to the Australian-wide coal strike. However it did not operate again. The Railway (Upper Darling Range) Discontinuance Act 1950 was passed on December 29, 1950 and the railway officially closed. On August 29, 1952 the last of the rails and sleepers were removed and the railway was eliminated.

The "West Australian" of July 23, 1964 reported that the zig zag railway track was to be converted to a scenic drive roadway 2½ miles long, for descending traffic, rounding the corners at the reversing points. It has spectacular views of the coastal plain.

A small zig zag railway was built at Mundaring Weir to take the railway from Mundaring down to the works site during construction of the dam in 1903. Parts of the zig zag was subsequently used for weir excursions.

*View of the Lithgow zig zag from high above the top road near Top Points with a Sydney-bound passenger train passing over the top viaduct, about 1908.*

—AUSTIN COCKERTON, LITHGOW



However a very important and interesting private line zig zagging up the Darling Range with five reversing points was built by Millar's Timber Company from the Government Railway at Yarroop to Nanga Junction. Each leg of the zig zag was approximately  $\frac{1}{4}$  mile long. The line then forked and ran north along the ridge twenty miles to Nanga Brook and south seven miles to Hoffman where the company had timber mills. The line was originally built in 1904. The line also carried passengers for a number of its early years. Government Railway waggons were drawn up the zig zag to be loaded for direct despatch to the ports of Bunbury and Fremantle. The line was closed in 1956.

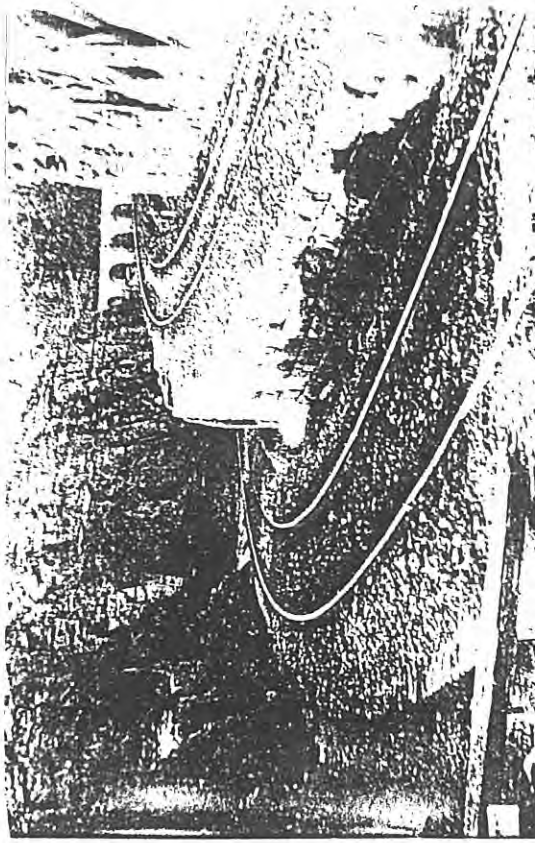
Zig Zag railways in Tasmania were introduced in the very rugged country of the Queenstown area. There it is a minor form of construction compared with the rack railways and rope haulages that were resorted to in overcoming the difficulties imposed by the terrain.

On the 2'0" gauge of the Mt. Lyell Mining and Railway Company two lines incorporating zig zags existed. One was on the railway for the construction of the Lake Margaret power station of the Mt. Lyell Company, the first hydro-electric station in Tasmania, the other on the railway to the Lyell Comstock Mine at Sedgewickvale.

In 1911 it was decided to construct the Lake Margaret power station on the Yolande River that takes the overflow from the lake at the foot of the western slopes of Mt. Sedgewick and joins the Henty River as it flows towards the coast.

For the transport of construction materials to the power station site a 2'0" gauge tramway was constructed from the Queenstown smelters in a westerly direction, crossing the Queen River to the village of Valetta, a distance of seventy-nine chains. There connection was made with the foot of an inclined haulage which rose out of the Queen River valley to Howard's Plains above where a tramway built in 1905 ran  $\frac{1}{4}$  mile west then two miles north to the timber village of Gozo following Burl Creek and crossing several timber trestle bridges on the way. That tramway had been used for transporting timber to the reduction works, using horse drawn trolleys but had not been used since 1907. Gozo was at the foot of a steep slope rising to a plateau above and the extension of the tramway beyond Gozo was constructed as a two reversal zig zag to Davey's Hill, the highest point on the line.

It then continued another 2 $\frac{1}{4}$  miles with heavy earthworks down to Swan Creek which it crossed by a four span trestle 20 feet high and 40 feet long, followed by a three span trestle 40 feet high and 80 feet long over Lerky Creek, another tributary of the Yolande River. The section

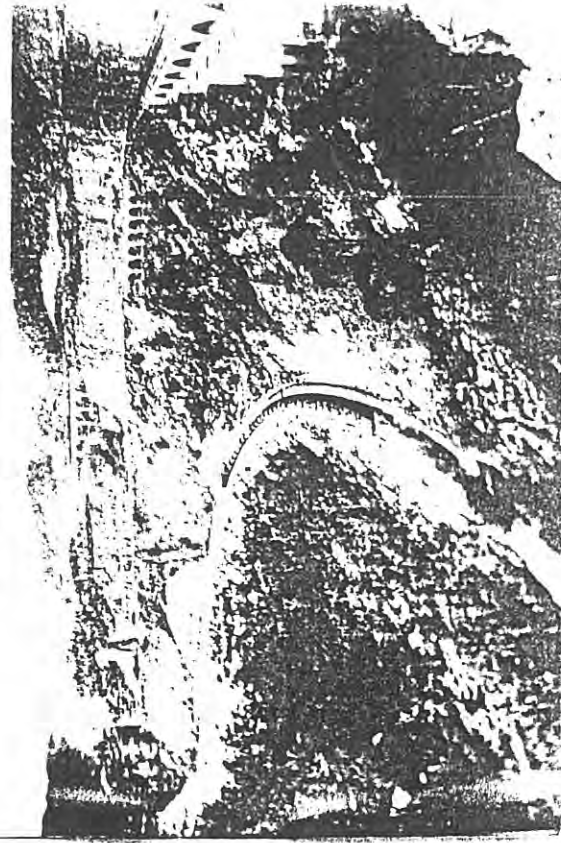


*Differences in track levels at Top Points. The stone ballast is seen, and the top viaduct in the distance.*

—NEW SOUTH WALES GOVERNMENT RAILWAYS

*The Zig Zag in the opening twentieth century when train saturation was being reached, showing trains on each level.*

—NEW SOUTH WALES GOVERNMENT RAILWAYS







*A special train conveyed railfans to Zig Zag to place a historic centenary marker on the tunnel to honour engineer John Whitton on October 18, 1969. The view shows the train drawn by 3801 running down the bottom road whilst on the left hand curve an electric inter-urban is seen. Lithgow Zig Zag Railway Centenary was celebrated on November 22, 1969. One feature was the Vintage Train here seen running down the bottom road.*

—PHILIP C. BAYLEY



to Valetta was completed on June 24, 1912 and to Lake Margaret village by December 16, 1912, a total of seven miles from the reduction works.

The 13,000 Kilowatt power station was commissioned on November 28, 1914 and the tramway continued as the only access between Lake Margaret village and Queens-town. A passenger rail motor was introduced in 1923 and the working of steam locomotives was discontinued in 1930. A second remote controlled station of 3000 Kilowatts was built in 1927, then in 1938 the rail access was replaced by the construction of roads through the area.

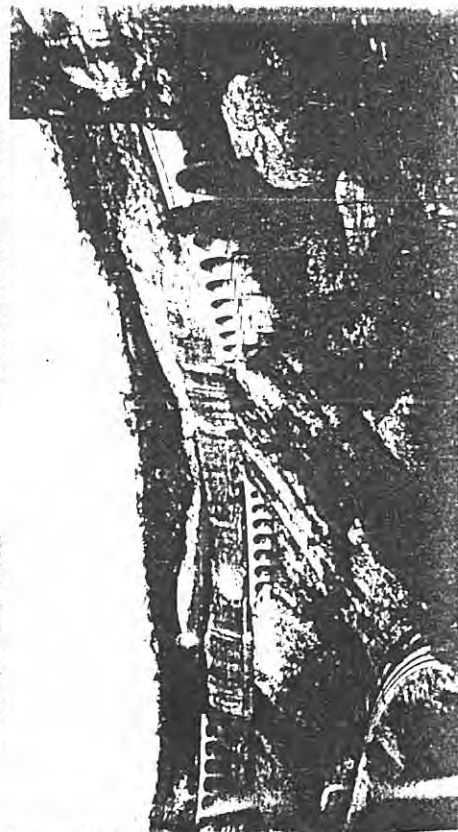
Another 2'0" gauge tramway built by the Mt Lyell Mining and Railway Company which contained two zig zags was opened on March 17, 1913 to provide access to the Lyell Comstock copper mine that the company had purchased in 1912. The line was eight miles in length, rising 300 feet to Sedgewickvale with a maximum grade of 1 in 90 and worked by steam locomotives. It branched from the Valetta line  $\frac{1}{2}$  mile from the reduction works, running north along the central Queen River for three miles, then after crossing the river the line turned easterly to enter the first zig zag, rising up the steep northern bank of the river gorge by the second zig zag at the four mile and reaching the village at the head of the valley at the foot of Mt. Sedgewick, six miles from the works, the foot of the Comstock mine haulage being another two miles.

The mine was closed from 1922 to 1929 but in 1937 three to four trains per shift, each of six hoppers with a total of 90 tons, were transporting 1000 tons of ore per day to the works. The railway was finally closed about 1941.

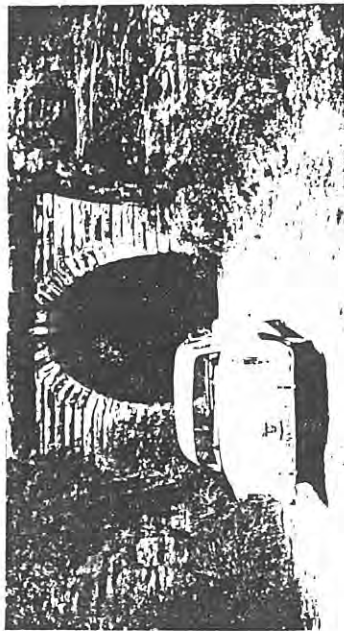
*"Instantaneous view of three trains on the Great Zig Zag".*

*All are goods trains: that on top viaduct Sydney-bound; on the middle road a haul-train descending; on lower road bound for the west.*

—CANEY, MOUNT VICTORIA







*Tourist's car about to enter the tunnel on the middle road in 1963. The tunnel is curved but no sooner does a car enter than the other end comes into view.*

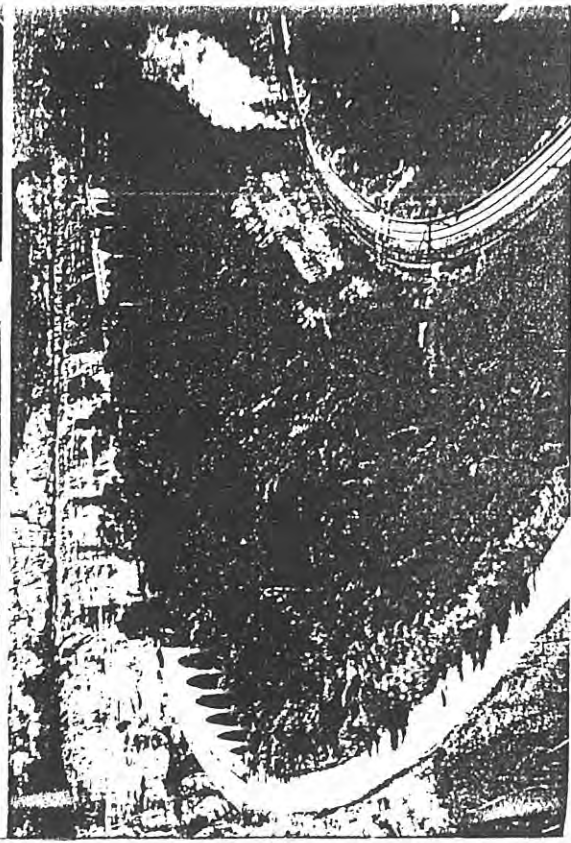
—WILLIAM A. BAYLEY

The only use of the zig zag system on the broad gauge of 5'3" is at Mildura on the Victorian Railways. To enable stock transported along the Murray River to be transferred to or from railway waggons a branch line from the station yard to the river bank was constructed.

Although close to the river the yard is on high ground some 100 feet above and the track leaving the yard has two reversing points before reaching the level of the bank beside the river, the second reversal forming access to an electrical substation above the river bank.

Another out of the way example of a zig zag railway, traces of which would be very hard to find, was constructed of 4'8½" gauge on the western side of Thornleigh on the New South Wales Government Main Northern Line. It was built in 1883-4 by Messrs Amos and Co., the contractors for the main northern line, to provide rail connection to a sandstone quarry to supply ballast. With the very rugged country between the Parramatta and the Hawkesbury Rivers and the advantage of obtaining the ballast on the higher sections of the line to minimise problems of haulage, the location of the quarry in one of the gullies west of Thornleigh appeared one of the most suitable although it was some 100 feet below and ¼ mile from the main line formation.

The use of a zig zag with two reversing points allowed negotiable grades for short ballast trains and after completion of the main northern line in 1889 the zig zag line to the quarry was left intact. It was again used in 1891 by Messrs Angus and Monie, contractors for the commencement of the duplication of the main northern line, but the zig zag line was taken up before the turn of the century.



*Car wheel tracks developing on the middle road in 1940 (top). A well-worn road in 1957 (lower) with a double-headed freight train on the bottom road. The ascending line is always used by locomotives to give a grip on the rails.*

—WILLIAM A. BAYLEY

## MIGHTY MOUNTAINSIDE MONUMENT

COMPARABLE with great monuments abroad the old zig zag remains an example of engineering skill found only in few parts of the world in its day and not surpassed in Australia.

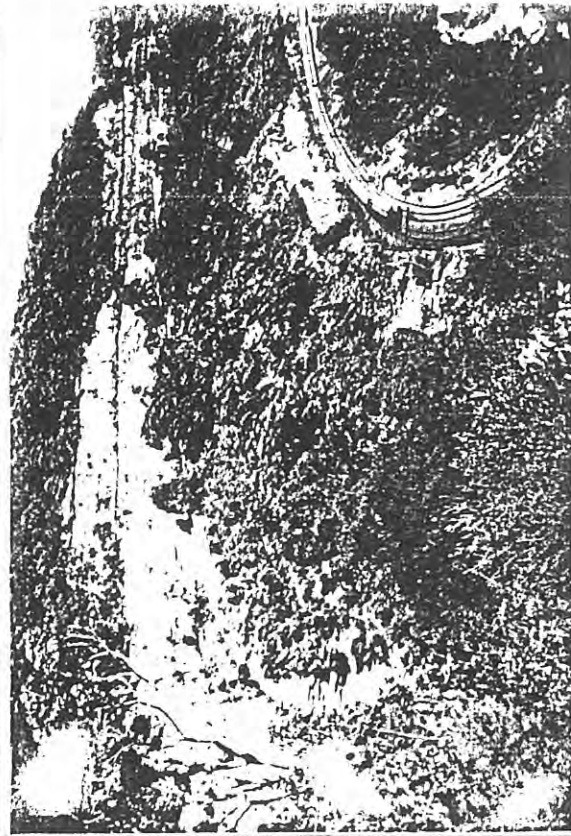
Unseen by passengers in trains it stood sentinel above the bottom road, the deviation of which has not been carried out. Work on deviation from Bottom Points to Eskbank was authorised on December 16, 1908 to give a grade of 1 in 90 to match the new line to be constructed from Bottom Points to Newnes Junction. From Bottom Points the line was to cross the creek and tunnel the mountain for twelve chains and after a similar distance across a gully in daylight enter a curved tunnel of forty-two chains which would have been the longest and, of course, the most suffocating with steam and smoke.

The line would then have emerged in the valley of Farmer's Creek which it would have followed down to meet the bottom road at the last eight chain curve. From the latter spoil from tunnelling was tipped to make a high embankment still remaining before work on that section of the deviation was stopped.

Increased engine power from the locomotive depot at Lithgow and Bottom Points took the place of deviation, resistance increasing as more powerful steam locomotives developed from 1910 until the introduction of the 36s in 1925, 57s in 1929, 38s in 1943 and the 58s in 1950. Their columns of smoke and steam shot up to the level of the top road making an awe-inspiring sight to tourists on the zig zag lookouts whilst mountains and valleys reverberated to their thunder. Heavier wheat, wool, stock and coal trains were moved by two 50 class and one 57 or 58 class leading and a push-up assisting to Zig Zag Box as demands grew heavier; the greatest steam engine power used on single trains.

The opening fifties saw the decision to introduce diesel locomotives for general use in New South Wales and to electrify the railway between Sydney and Wallerawang, through Lithgow and Bowenfels. Work was put in hand in the mid-fifties and when overhead wiring was installed in the tunnels diesel locomotives hauled the trains over the Blue Mountains in an effort to keep the wires free of soot during 1957, towards the end of which electric locomotives took over the goods and long distance passenger trains whilst inter-urban electric carriage sets provided the service from Sydney to Bowenfels.

Silence descended on the valleys where today the noiseless movement of the trains passes almost unnoticed by the tourists inspecting the mighty zig zag which remains a silent memorial to engineers and railwaymen of a by-gone age.



*A heavy triple-headed train, with push-up engine lifts out of Lithgow to thunder up the lower road (top) and at bottom silence reigns as an electric inter-urban passenger train rolls around the eight-chain curve on the lower road.*  
—C. A. CARDEW AND WILLIAM A. BAYLEY

### Fellowship.

Mr William A. Bayley was elected a Fellow of the Society. Mr Bayley is the author of the following historical volumes : *History of Bega*; *William Duggan Tarlington—Biography of an Early Pioneer*; *Seventy-five Years of Bega Methodism*; *Uplands Pastures—The History of the Crookwell District*; *Commonwealth Jubilee History of the Central South Coast of New South Wales*; *Days of Our Century—Crookwell Shire*; *Gundowringa—The Life and Work of Charles Ernest Prell, O.B.E.*

In addition to his authorship, Mr Bayley was responsible for the collection of upwards of 1,200 files of various country newspapers, the majority of which are now in the Mitchell and the Public Libraries. Mr Bayley has also done valuable work in the indexing of country references in a large number of New South Wales newspapers.

### Members' Meetings.

Ten General Meetings, including the Annual Meeting, were held during the year, all of which were very well attended.

The Annual Meeting was held at History House on February 27, 1951, when the President (Mr J. K. S. Houison) presided over a large attendance.

After formal business, followed by the adoption of the Annual Report and Financial Statement for the year ended December 31, 1950, and by the announcement of the result of the Annual Election for 1951, the President (Mr J. K. S. Houison) (unopposed) thanked members for his re-election. It would be his endeavour, said Mr Houison, to do everything in his power to further the best interests of the Society.

A full report of the Annual Meeting, referred to above, appeared in Vol. XXXVII., Part I., of the Society's *Journal*.

A number of excellent papers were read to members at the monthly meetings, as follows :—

MARCH 27—E. C. Rowland, F.R.Hist.S., F.R.G.S. : "Rose Bay, Vacluse and Watson's Bay" (illustrated).

APRIL 24—Kenneth G. Allars, B.A., LL.B. : "Sir William Westbrooke Burton" (illustrated).

MAY 29—Malcolm H. Ellis, F.R.A.H.S. : "Early Military Regiments in New South Wales" (illustrated).

JUNE 26—Mrs K. Aubrey, M.A. : "Powers of Local Government in New South Wales, 1842-1906." Owing to Mrs Aubrey's inability to be present, a running precis of her long paper was read by Mr C. Price Conigrave (Fellow).



Royal Australian Historical Society

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FIFTY-FIRST  
**ANNUAL REPORT**  
AND  
STATEMENT OF ACCOUNTS  
for 1951.

With a List of Members.

Presented at the Annual Meeting,  
February 26, 1952.

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Vol. XXXVII.

Part VII.

Sydney  
1951.



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**JOURNAL  
OF THE  
ROYAL AUSTRALIAN  
HISTORICAL SOCIETY**

**CONTENTS  
INDEX VOLUME 58**

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**Vol. 58 Pt 6**

**1973**

**PRICE TO NON-MEMBERS: \$1.00**

Registered at the G.P.O. Sydney, for transmission by Post as a Periodical (Category B).

*STANDARD GAUGE RAILWAY ACROSS AUSTRALIA*, W. A. Bayley; *LITHGOW ZIG ZAG RAILWAY*, W. A. Bayley, Zig Zag Press, Bulli, \$1.00 each.

William A. Bayley, F.R.A.H.S., has put railway historians in his debt by bringing out two popular, well-illustrated accounts of memorable changes in our railway systems. *Standard Gauge Railway* tells the story of the new route across Australia and then looks back to the beginning of railways in this country and outlines early railway travel between Queensland and Western Australia. Well-illustrated and clearly written, it has photographs to delight the enthusiasts for steam as well as pictures of the Indian-Pacific express.

*Lithgow Zig Zag Railway* is the history of two abandoned zig zag railways, both designed by John Whitton. The Little Zig Zag at Lapstone was opened in 1867. The Great Zig Zag, raising or lowering trains 470 feet in one and a half miles, was between Clarence and Lithgow. A tourist attraction before it was opened in 1869, it has become a tourist attraction again now. Bayley's excellent account manages technicalities lightly, is well-illustrated and shows convincingly why the two zig zags were constructed and why both were abandoned.

JOHN M. WARD.

### Books Received

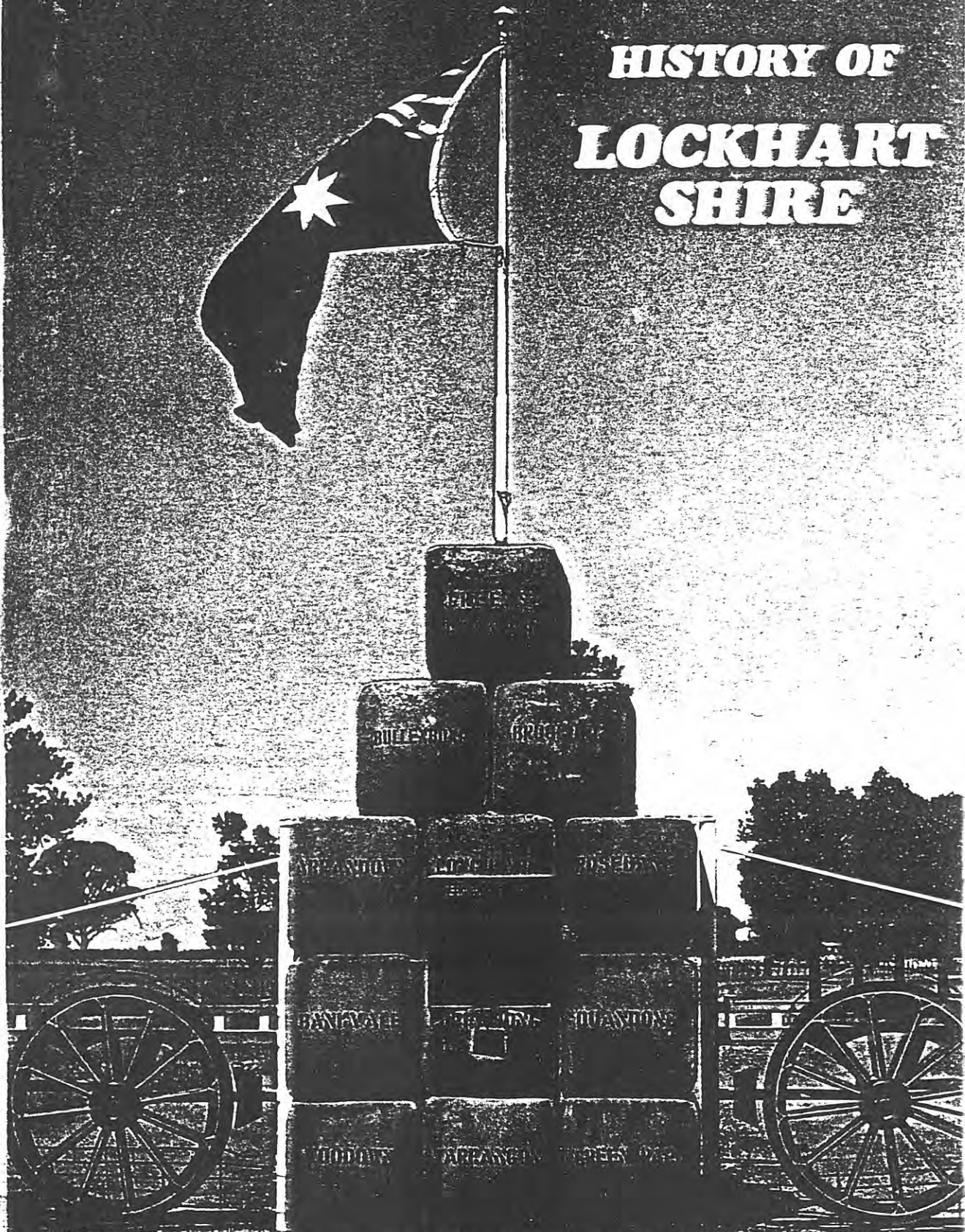
Ron J. Gibson, *AUSTRALIA AND AUSTRALIANS IN CIVIL AVIATION, 1823 to 1920*, Volume I, Qantas Airways Ltd, Sydney, 1971, 93 pages, index. A valuable work of reference. Mr Gibson is Controller, Research and Information Bureau, Qantas. Copies are obtainable from Qantas. \$2.50 each plus 25 cents postage.

*THE AUSTRALASIAN SKETCHER, 1880*, Heritage Publications, Melbourne, 1971. A handsomely reproduced facsimile of the *Australasian Sketcher* for the year 1880, index, \$19.50.

*THE AUSTRALIAN THUNDERER: 'The Age' after the Gold Rush, 1854-1859*, Heritage Publications, Melbourne, 1971, with an Introduction by Michael Cannon, pp. x + 102, index, \$3.60. Contains extracts from the *Age* on such diverse subjects as the Eureka Rebellion, the Rights of Women, the Toorak Swindle, Plots of the Squatters, Spies in the Telegraph Office, the Share Buying Mania, Smallpox in Australia and many more. An entertaining and attractively produced book.

# LAND GALORE

## HISTORY OF LOCKHART SHIRE



**WILLIAM A. BAYLEY**



To facilitate community living the villages grew, expanding slightly to country townships along the main railway line and to the west of it; centring on Lockhart which with local government became the pivotal point of the prosperous area.

This book records in some detail the growth and development of the eastern part of the Riverina, stimulating the interest and pride of its pioneer citizens and providing for the needs of the coming generation to study and be inspired to maintain and improve the legacy of the passing generation.

Council commissioned for the purpose the eminent local historian, William A. Bayley, F.R.A.H.S., who has successfully compiled many histories of country towns, all of which have been well received and some of which have reached several editions. *Land Galore* will spread the story far and wide and imbue its citizens with pride in their achievements.





By the same author : *William A. Bayley*

HISTORY OF BEGA (1942).  
UPLANDS PASTURES — HISTORY OF CROOKWELL DISTRICT (2ND ED. 1975).  
DAYS OF OUR CENTURY — SHIRE OF CROOKWELL (1951).  
BEHIND BROULEE — CENTRAL SOUTH COAST — NEW SOUTH WALES (4th ed. 1977).  
HILLS OF GOLD — CENTENARY HISTORY OF NUNDLE SHIRE (1953).  
LILAC CITY — THE STORY OF GOULBURN (1954).  
BORDER CITY — HISTORY OF ALBURY (2ND ED. 1976).  
GOLDEN GRANARY — HISTORY OF GRENFELL AND SHIRE OF WEDDIN (1954).  
RICH EARTH — HISTORY OF YOUNG AND THE SHIRE OF BURRANGONG (1956).  
RICH EARTH — HISTORY OF YOUNG (1977).  
BILLABIDGEE — HISTORY OF URANA SHIRE (1959).  
GREEN MEADOWS — CENTENARY HISTORY OF SHELLHARBOUR MUNICIPALITY (1959).  
BLUE HAVEN HISTORY OF KIAMA MUNICIPALITY (2ND ED. 1976).  
BLACK DIAMONDS — HISTORY OF BULLI DISTRICT (3rd ed. 1975).  
WOLLONDILLY SHIRE — PICTON AND DISTRICT (1956).  
DOWN THE LACHLAN YEARS AGO — HISTORY OF CONDOBOLIN (1965).  
HISTORY OF CAMPBELLTOWN (2ND ED. 1974).  
KANGAROO VALLEY (2ND ED. 1966).  
NEW SOUTH WALES — AROUND AUSTRALIA PROGRAMME (1966).  
YASS MUNICIPAL CENTENARY HISTORY (1973).  
THE CHILDREN'S ILLAWARRA (1973).

### Historical Biography

WILLIAM DUGGAN TARLINGTON 1806-1893 (1946).  
GUNDOWRINGA — LIFE AND WORK OF CHARLES ERNEST PRELL (2ND ED. 1965).

### Economic and Industrial History

HISTORY OF THE FARMERS AND SETTLERS' ASSOCIATION OF N.S.W. (1957).  
ILLAWARRA PASTURES — CELEBRATING THE DIAMOND JUBILEE OF THE ILLAWARRA  
CO-OPERATIVE CENTRAL DAIRY SOCIETY LIMITED (1959).  
DIAMOND JUBILEE — NOWRA CO-OP. DAIRY CO. LTD. 1902-1962 (1962).

### Austrail Publications

LITHGOW ZIG ZAG RAILWAY (3RD ED. 1973).  
STANDARD GAUGE RAILWAY ACROSS AUSTRALIA (2ND ED. 1973).  
STEAM TRIUMPH ON RAILWAY ACROSS AUSTRALIA (2ND ED. 1972).  
RAILWAY CENTENARY IN TASMANIA (1971).  
PORT ARTHUR RAILWAY ACROSS TASMAN PENINSULA (1971).  
LAPSTONE ZIG ZAG RAILWAY (2ND ED. 1975).  
TUNNELS ON AUSTRALIAN RAILWAYS (2ND ED. 1974).  
STEEL WHEELS ON RAILWAY TO WHYALLA (1973).  
PICTON-MITTAGONG LOOP-LINE RAILWAY (2ND ED. 1976).  
PICTON-MITTAGONG MAIN-LINE RAILWAY (1975).  
PICHI RICHI RAILWAY (1975).  
THE GREAT ZIG ZAG RAILWAY AT LITHGOW (1977).  
SYDNEY SUBURBAN STEAM RAILWAYS (1978).

## WOLLONGONG BOATHARBOUR: A PROGRESS REPORT

The battle rages on, even if at present it is only preliminary skirmishing.

Certain Government authorities are trying to hoist the public with their own petard. They argue that public opinion was overwhelmingly in favour of the continuance of the fishing fleet in the harbour, and this is perfectly correct. But, they argue, in order to survive, the fishing fleet must have better facilities; and **therefore** there has to be a factory and associated services built on what is the main central spur, which means the most conspicuous place in the whole area, right in the heart of things.

They go on again: before this can be done, the boat-launching ramp has to be moved. Where? The suggestion was Port Kembla Harbour. However, the Maritime Services Board says it may not go into Port Kembla; **therefore** it has to be relocated on a great concrete pad constructed over natural rocks hard up against the Continental Baths, providing parking space for fifty-five cars and as many trailers, not to mention some buildings. There will then be consequent hazards of cars and trailers turning off Cliff Road in week-end traffic and across access tracks used by the great numbers of people going to and from the baths, including many children.

Now in all logic there should be no such **therefores** in these two specious arguments. Because the public wants the fishing fleet to continue does **not** mean the public wants to see the whole harbour taken over by a fishing industry; and that is what will happen, because in addition to the buildings there must be roads and parking areas for them, plus a good deal of filling of the little beach near the pylon of the old T-jetty. And in relation to the boat-launching ramp, if it cannot go to Port Kembla then it certainly does not have to cover natural rocks, create a traffic hazard and induce the omission of noxious fumes from vehicles, since the maximum uses of baths and parking area will occur at the same time. If the authorities have their way, a health area will be poisoned atmospherically.

So it has become abundantly clear that the boat-launching atrocity is only the thin edge of the wedge; it is the first step in the destruction of a place of beauty, calm, and historic interest. As such it has to be opposed vigorously. Sectional interests must not be allowed to push the public in general out of a place it holds very dear, as being the very centre of our historical origins—the only substantial part of it we have remaining to us—and a place of lasting enjoyment for young and old.

In all this bad news, there are elements of good news. Firstly, it is most gratifying to note that our City Council has turned the proposal down flat. On the other hand, the Council does not control the area, and has no power to stop the proposed works which we are informed are definitely to proceed—or so the Departments concerned think. The second good news is that the stone structure of the old harbour is to remain untouched, and not altered out of all

recognition as previously proposed. Therefore it can be seen that we and other opponents of this desecration have had a great deal of success to date. Now we have to convince the authorities that our old harbour has grown into something that already has a maximum use; that it has character and charm as it is; that, as such, it is to be "developed" it simply cannot survive as we know it and enjoy it; and that the only changes should be the removal of errors of the past, not the perpetration of new ones. After all, where will the arguments of the authorities finish? They could just as logically—or illogically—argue that the place has to be "developed" because without it the **Queen Mary** couldn't be launched there. The fact is our toy colonial harbour was never meant for such things. It has reached optimum development and popular enjoyment with a balanced usage, and must remain that way.

Members may be assured the Society's Council is doing its utmost in the cause. Meanwhile, they are urged to get as many signatures to the circulated petition as possible. Further copies can be obtained from my office (176 Keira Street, Wollongong), or by phoning Mrs. King there (291188). And could all petitions be handed in by, say, the July meeting of the Society?

Keep up the good work.

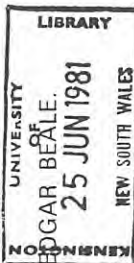
## OBITUARY

Mr. W. A. Bayley, F.R.A.H.S.

It is with the deepest regret that we report the death of one of the Society's hardest-working, most valuable and most distinguished members, Mr. William Alan Bayley, F.R.A.H.S.

The resolution unanimously adopted by the Council of the Society at its May meeting will undoubtedly be endorsed by the entire Society: "That the Council place on record its appreciation of Mr. W. A. Bayley's great and valuable services over many years to the Society and to the study of Australian history generally, and its sense of loss at his death, and extends its deepest sympathy to Mrs. Bayley and their family."

It is hard to imagine the Society without Bill Bayley—he has played such a large part in its activities for so long. His reputation as a historian was already established when he came to Illawarra as a headmaster, briefly at Waniora and Farmborough Road, and then for many years at Bulli, from which he retired. The Society lost little time in recruiting him in 1956 to the Council, and in the following year appointing him Honorary Research Officer, a position for which he was eminently qualified by his experience in research and his extensive knowledge of source material. He held his office until 1974, except for the two years (1961 and 1962) of his presidency. In 1975 he became Honorary Secretary, a post he retained until last year failing health compelled him to relinquish it for the less exact-



ing position of Vice-President. He remained an active Councillor and continued to attend meetings until very shortly before his death.

From time to time, over long periods, he combined with his other offices that of editor of the Society's Bulletin, enlarging and greatly improving it, and also organising its distribution.

He was the author of over forty historical works, particularly municipal and shire histories, of which his histories of Bulli, Shellharbour, Kiama and Shoalhaven are of particular local interest. A most useful contribution to local history was "The Children's Illawarra"; he was at work on a companion work, "The Students' Illawarra," even during his last illness. Another field, that of railway history, he made particularly his own, establishing Austral Publications to meet an ever-growing demand. His experience and expertise enabled him to render the Society invaluable service in organising and supervising the production of our own publications.

He was a frequent speaker both at our own meetings and those of other societies, and many times acted as guide to visiting societies. His wide knowledge of the history of the district gave him the advantage of being able to act as speaker or guide on short notice or none.

Not the least of his services to the Society lay in his unique ability to extract financial assistance from government departments and public bodies. Whenever such an application was to be made, it was to him that we turned.

An indefatigable photographer and collector of historical material, he has left the Mitchell Library, the Wollongong Public Library, and the Society's own collection all richer for many generous donations of photographs and material, the latest of which was recorded in our last issue.

This impressive record of service clearly shows how much Bill will be missed and how hard it will be to replace him in his many capacities. But what we will miss most is the man himself—his friendly personality, his readiness to give his time and energy and to share his vast knowledge with less experienced historians or casual enquirers, and the enthusiasm with which he promoted all the Society's activities and interests. He made a great contribution not only to the Society but to the district and to many aspects of Australian historical knowledge and all are the poorer for his passing.

#### Mr. N. E. A. Lamerton, LL.B.

We record also with deep regret the death, after a long illness, of Mr. Noel Lamerton (member). Although other commitments, and latterly ill-health, prevented him from attending monthly meetings regularly, he and Mrs. Lamerton did so whenever possible, and participated in many of the Society's excursions. Mr. Lamerton was also a contributor to the Bulletin, and took a great interest in the Society's work generally.

He practiced as a solicitor in Wollongong for many years, being at the time the legal adviser to Shellharbour Council. He

was highly respected by other members of the profession for his ability, integrity and unfailing helpfulness and courtesy—a respect testified by his election first to the Secretaryship and afterwards to the Presidency of the Wollongong and District Law Society.

Mr. Lamerton also made a great contribution to the musical life of Wollongong, being for many years a very active member of the Choral Society and took a leading part in the establishment of the Wollongong Conservatorium.

To Mrs. Lamerton and their daughter Sue the Society extends deep sympathy.

### THE CHITTICK FAMILY HISTORY

On 30th and 31st August last year, the descendants of Gustavus and Jane Chittick commemorated the centenary of the arrival of the family in Australia. In honour of the occasion members of the family have compiled a 68-page booklet tracing the lives and careers of members of various branches of the family.

They started with few material advantages. While still residing in County Fermanagh, Northern Ireland, Gustavus was killed steep-chasing, leaving Jane a widow with eight children. She carried on the farm for some years, then decided to emigrate to Australia, where her brother James Moffitt was already settled at Gerringong. On the voyage she contracted typhoid fever and died a few weeks after her arrival. It was found that the money she had sent ahead had been misappropriated, and the young Chitticks were left with ten shillings each with which to start a new life. But, says the author of the booklet, "these young people had inherited from Gustavus and Jane an even greater legacy: something of their courage, character and high ideals, plus ambition and a capacity for hard work." The booklet is a record of how they battled through, of solid and well-earned if unspectacular success, and of faithful service to their communities and their church. Most of them were connected with dairying and cattle-breeding in Illawarra or on the North Coast; many have been active in local government and in agricultural societies.

As one reader remarked, the booklet should be required reading for the work-shy and strike-happy—they might find that in comparison with the pioneers they were not so badly off.

The booklet is obviously a labour of love and a work of family piety. It is also a valuable record of the fortunes of one family, typical in many ways; exceptional perhaps in their foresight, capacity for hard work, and close-knit family ties. It was such people who were the backbone of the old rural Australia.

("The Chittick Family History"; privately printed).

### PERSONAL

The Society extends its sincere sympathy to our Treasurer, Mrs. Amelia Pezzullo, on the recent death of her father.



Salisbury, Wiltshire, England. The Bishop passed my letter on to the County and Diocesan Archivist of the Record Office of the Wiltshire County Council. He in turn has been able to establish the authorship. The attribution is beyond questioning.

The Rev. Thomas Hochkis (as the name is recorded) was instituted in a distant parish of Wiltshire with the fascinating name of Stanton Fitzwarren. And the time? As far back as 1637; and he was still there in 1694. It would be too much to say that these sermons, devout and concentrated in faith and expression, span the whole of that period of nearly sixty years. But the facts show that the author of these devotions began ministering to the spiritual needs of his simple, rural folk when the reign of Charles I of England was running its troubled course towards his execution and the great civil wars. Quietly he went on, while England reeled under the clash of arms, the New World opened, and Dutch navigators and others probed the mysteries of the East and Terra Australis. The Restoration came, with peace and advancing discovery, while this good man preached his beliefs on the eternal verities in what to him seems to have been an unchanging world, however far-reaching the changes in reality.

So it was fitting, in a way, that his texts should have turned up centuries later, in a land which in his time was a matter of speculative deduction and vague encounters. And it is equally fitting that the Society's Council has decided that this errant antiquity should return at last to where it rightly belongs, to be retained in the archives of that part of peaceful old England whence it came.

—EDGAR BEALE.

### UNIQUE DONATION

Heritage Week was marked by a presentation ceremony in the Wollongong City Library. The presentation was of hundreds of slides and negatives and of documentary material on the Illawarra district collected by the well-known historian Mr. W. A. Bayley.

Mr. Bayley, a Fellow of the Royal Australian Historical Society, is the author of some forty publications. He is a recognised authority on railway history in Australia, and has also published volumes commemorating the centenary of local government in the Municipalities of Shellharbour and Kiama and the Shire of Shoalhaven, and many other local government areas in New South Wales.

Mr. Bayley was unfortunately involved in a motor accident a couple of days before the presentation, and could not participate in the function. His place was taken by Mr. Jack Maynes, who referred to this great gift to the people of the Illawarra district as one which could not be measured in terms of money, but would be of immense value to future generations in bringing back the past.

The ceremony was attended by the Lord Mayor (Ald. Frank Arkell), the Deputy Lord Mayor (Ald. Bill Mowbray), and many local



## ILLAWARRA HISTORICAL SOCIETY BULLETIN

Founded 5th December, 1944 — Our Thirty-seventh Year

Affiliated with • Royal Australian Historical Society  
• National Trust of Australia (N.S.W.)

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The monthly meeting of members of the Society is held on the first Thursday of each month (except January) at the conference room of the Wollongong Town Hall, Crown Street, Wollongong, commencing at 7.45 p.m.

**JUNE MEETING: Thursday, 4th June, 1981, at 7.45 p.m.**

**Speaker:** Mr. R. N. BRANNON

**Subject:** The Illawarra State Recreation Area.

Mr. Brannon is the President of the new Illawarra State Recreation Area Trust, which has been formed to administer the important escarpment along a large section of the Illawarra coast. It has been donated in perpetuity and is perhaps the most important conservation undertaking applicable to our region. It will affect the lives of generations unborn, ensure preservation of rainforests and their native fauna and flora, and provide unique recreation facilities for the people in a natural environment.

We are fortunate to have a speaker who can enlighten us on the history, formation, objects and policies of a new organization which in itself is history in the making.

Usual supper arrangements. (Donation 30 cents).

### MAY MEETING

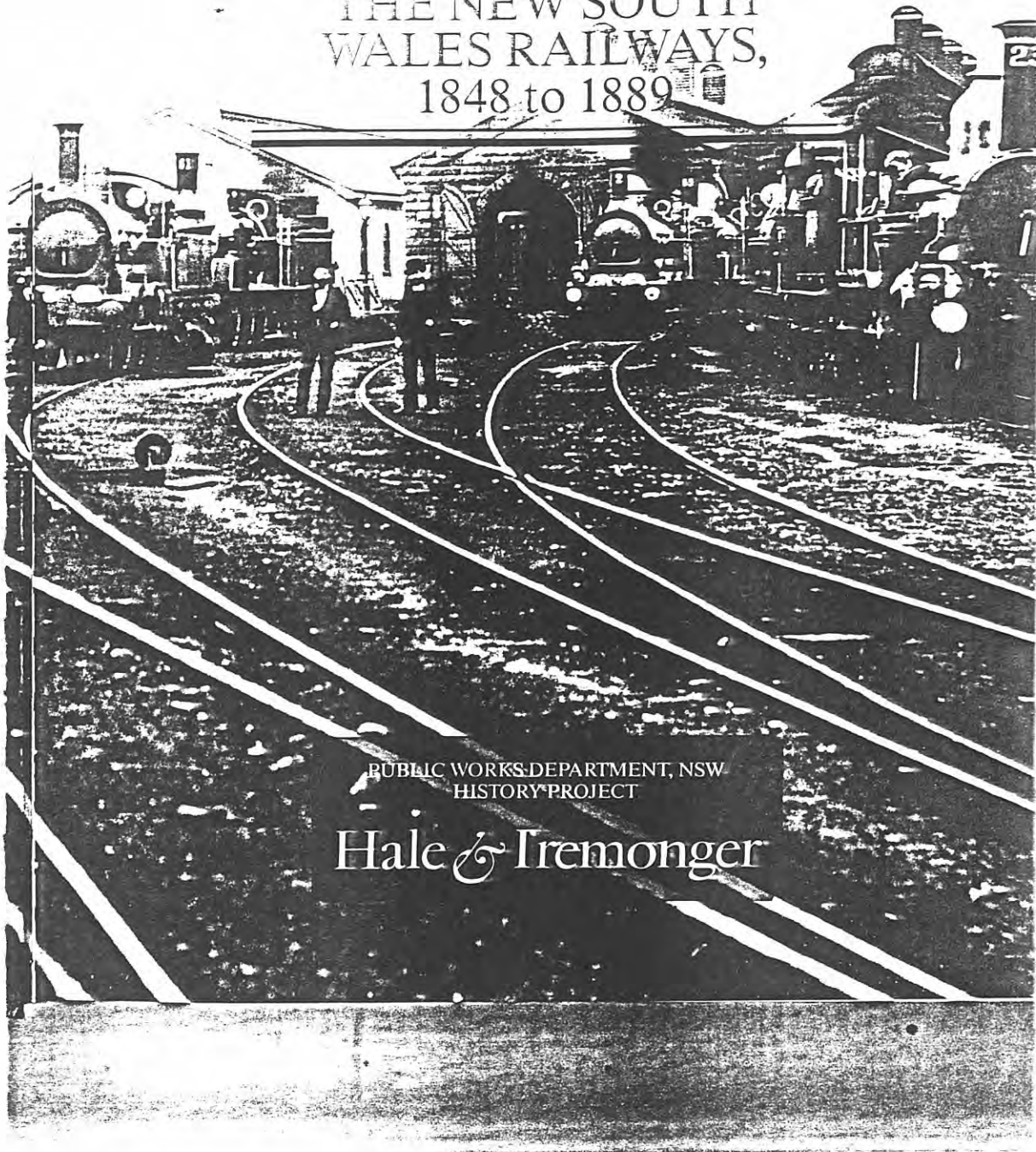
The speaker at the May meeting of the Society was Mr. Allen Grosse, Heritage Officer, Environmental Heritage Committee, whose subject was "The Work of a Heritage Officer." A summary of his talk will appear in a later issue.



ROBERT LEE

# THE GREATEST PUBLIC WORK

THE NEW SOUTH  
WALES RAILWAYS,  
1848 to 1889



PUBLIC WORKS DEPARTMENT, NSW  
HISTORY PROJECT

Hale & Iremonger

Robert Lee was born in Sydney in 1952 and has lived there for most of his life. Educated at Macquarie and Sydney universities, he now teaches history at Macarthur Institute of Higher Education in the city's south western suburbs. He has been an enthusiastic traveller, by train when possible, in Australia, Europe, and Asia, and this book is the culmination of a life-long interest. He is at present working on a study of French imperialism in late 19th-century China, where railways were also an important element in that society's transformation.

**The Greatest Public Work** is the fourth volume in a series prepared by the History Project within the NSW Public Works Department. Other volumes include *Historic Court Houses of New South Wales*, *Landmarks in Public Works*, and *James Barnet: Colonial Architect*. Forthcoming is *An Unreasonable Man*, a biography of J. J. Bradfield.

*Front cover:* A passenger train is about to leave Bathurst shortly after the railway's opening in 1876. No. 33 was built in Manchester in 1870, while the carriages, except for the centre car with the raised roof, were built locally.

*Back cover:* An almost surreal invocation of Mercury and the gods of steam and iron frame more human scenes of Sydney station and the great Zig-zag. The colour lithograph on the cover of the 1879 Railway Guide of New South Wales was a remarkable example of Victorian iconography.

Goulburn, represent the first phase in metal bridge construction in New South Wales. The ironwork was imported from England in each case. The sandstone piers and assembly of the bridge were carried out by William Watkins, who also was the contractor for most of the earthworks from Penrith to Mount Victoria. The bridge opened together with the entire twenty-eight mile (45 km.) section from Penrith to Weatherboard (now Wentworth Falls) on 11 July 1867.

The initial ascent of the eastern escarpment involved building a 126-foot (38.4 m.) high seven-arch sandstone viaduct over the Knapsack Gully. This viaduct followed the design of the stone viaduct across Stonecutters Creek at Picton. The nature of the terrain is emphasised by the fact that these viaducts carried rails on grades of one in thirty and one in forty respectively. Such stone arch viaducts were Whitton's standard means of bridging medium-sized obstacles in the 1860s. Like the Roman aqueducts on which they were based, they are extremely durable: all still exist, but since they were built to carry a single track, only the Picton viaduct, built for double track because of its proximity to the station, still carries railway traffic. The Knapsack viaduct, like the iron-girder Penrith Bridge, now carries a road.

Shortly beyond the viaduct, Whitton located his first zig-zag. Trains were required to reverse twice to climb some 526 feet (160 m.) on one in thirty-three grades to reach the summit of Lapstone Hill. From there the railway, like the road built fifty years before, followed the main range to Mount Victoria, climbing steadily on grades often as steep as one in thirty. The extension from Weatherboard to Mount Victoria opened on 1 May 1868. From there the road and railway diverged. The road descended Mount York sharply to reach the fertile Hartley Valley and the easier undulating country to Bathurst. Whitton found Mount York an impossible prospect for railway construction, and instead took the railway to the north across the Darling Causeway, through a 539-yard (493 m.) tunnel under Mount Clarence and down a second zig-zag into the Lithgow Valley.<sup>28</sup> The route passed through wild and inhospitable country and its choice was not without its critics, especially in Hartley, destined to be by-passed by the railway. In 1864 some 403 inhabitants of the area petitioned the Legislative Assembly to take the line through Hartley rather than Lithgow, arguing with some justice, that Whitton's line

passes through about sixty miles of a waste and unproductive region, almost destitute of sustenance for man or beast, and is scarcely suited for the denizenship of kangaroo and wallaby.<sup>29</sup>

Engineering imperatives, however, meant that Hartley, like Berrima in the south, would become a town almost ruined by the divergent routes followed by the road and railway. From Mount Victoria the railway continued to climb to reach its summit of 3,658 feet (1,114 m.) at the portal of the Clarence tunnel. From Penrith it had ascended 3,570 feet in fifty-four miles (1,088 m. in 87 km.), an average gradient of one in seventy-eight. Much of the climb, however, was achieved in the first thirty miles (48 km.) from Penrith, where the average gradient was one in forty-nine. John Rae described the problem beyond Clarence and its solution:

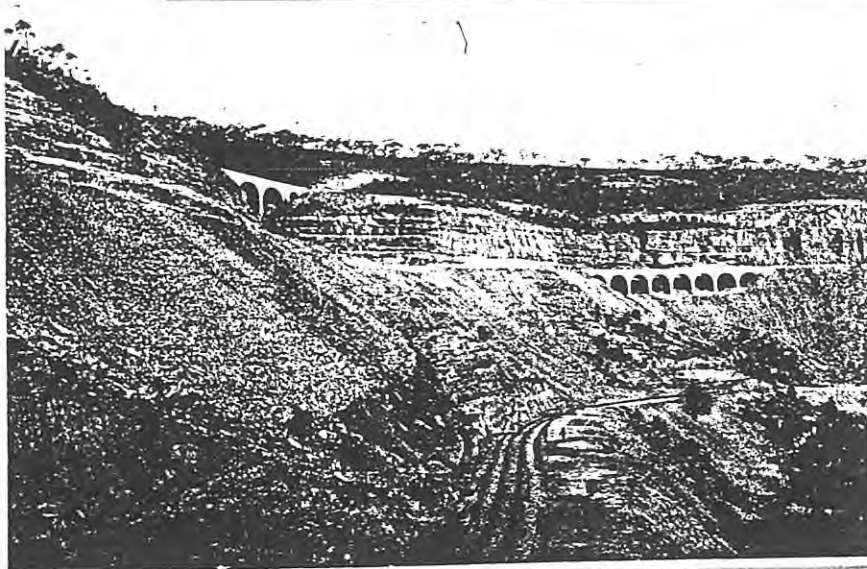
From the Clarence tunnel to the bottom of the [Lithgow] valley there is a descent of 470 feet [143.2 m.], through a deep and rugged ravine, where formerly there was scarcely footing for the mountain goat, and where the surveyor's assistants had occasionally to be suspended by ropes in the performance of their perilous duties. But human skill and enterprise have opened a pathway through these broken mountain ranges for the railway train, that now traverses the sides of the mountains on a grade of 1 in 42.<sup>30</sup>

The Great Lithgow Zig-zag involved the construction of three elegant stone viaducts, one of five and two of nine arches; cuttings up to eighty feet (24 m.) in depth; and two

Opposite top: The first major obstacle on the ascent of the Blue Mountains was the Knapsack Gully. Whitton spanned it with a stone arch bridge on a one in thirty gradient. Just beyond the bridge, trains reversed to climb the escarpment by zig-zag. Lucasville platform, to the left and above the bridge, was on the zig-zag's middle road. Trains first crossed the bridge in 1867; today it carries the Great Western Highway (GPH). Bottom: Whitton ascended the eastern escarpment of the Blue Mountains with the first of the two zig-zags on the western line. It opened in 1867. The site of the lower reversing station is now on the Great Western Highway. There were no signals to control train movements, and conditions for the pointsman were austere (AONSW)

28 Rae Report 1865, pp. 21-2; Rae Report 1873, pp. 6-7. On the building of the Great Western Railway see P. Belbin and D. Bourke, *Full Steam across the Mountains* (Sydney: Methuen, 1981), pp. 38-51. On Whitton's bridge designs see D. J. Fraser, 'Civil Engineering in N.S.W. 1881-1905' *ARHS Bulletin* vol. 36, no. 578 (1985), pp. 267-79.  
29 Petition, 4 January 1865, NSWLA VP 1863-4, vol. 4, p. 173.  
30 Rae Report 1873, p. 7.

*The Zig-zag in the Lithgow Valley was very new when this photo was taken around 1870. Whitton's technique of enclosing the ballast between sandstone blocks is visible on the bottom road (GP)*



tunnels, one of which was opened out into a cutting before completion. The fifteen-mile (24 km.) contract from Clarence tunnel to Wallerawang was, at £328,284, easily the most expensive yet let in the colony. The contractor, Patrick Higgins, was required to build three tunnels and seven stone viaducts to bring the railway down onto the rich country of the western slopes. The precipitous nature of the slope down which the zig-zag was built and the unpredictable, often savagely cold and windy climate of the valley, made the task especially difficult. On two occasions, electrically ignited blasts were used to move large masses of rock. In each case over three tons of powder were used to move about 45,000 tons of rock. The Superintendent of Telegraphs, Mr Cracknell, designed and supervised the wiring for the blasts, which spectacularly achieved their aims. Rae described the first tearing 'the mountain asunder, heaving huge masses of rock into the valley, and leaving the face of the parent mountain almost as if it had been cut with chisel'.<sup>31</sup>

Both blasts were festive occasions. The first, on 5 January 1867, was attended by a disparate group of officials, engineers, contractors and local notables.

Shortly after the explosion had taken place, the party, numbering upwards of fifty persons, sat down to an excellent luncheon, served in No. 1 Tunnel. A better or cooler place for a luncheon, considering the intense heat of the weather, could not be conceived. . . . The operations of the morning had fully prepared the company for the luncheon; and poultry, cold joints, together with champagne, sherry, and delicious cawarra, disappeared in the most surprising manner.<sup>32</sup>

The second blast on 16 September 1868 removed the mass of unstable rock above what was originally to have been No. 2 tunnel. This was a vice-regal occasion, and the blast was detonated by the Countess of Belmore, witnessed by her husband the Governor, an anxious Cracknell and 'a large concourse of spectators, who had assembled to witness the effects of the explosion'. Railway building had become a spectator sport under the highest patronage in the land.<sup>33</sup>

The abandonment of No. 2 tunnel was not the only aspect of the zig-zag that did not run quite to plan. Whitton had appointed William Hull as Resident Engineer on the Great Western Railway in 1865. Hull had previously occupied the same position on the Melbourne to Bendigo line, which was then easily the most extravagantly and splendidly engineered railway in Australia.<sup>34</sup> However on the zig-zag his relations with his subordinates were poor, and, when a culvert collapsed soon after completion, four of them accused Hull of failing to oversee the contractor's work properly. Whitton was on leave so his deputy, William Mason, investigated and found considerable negligence on Hull's part. In March 1868 he was dismissed and George Cowdery, whose work on the Goulburn

<sup>31</sup> *Ibid.* p. 8

<sup>32</sup> *SMH* 7 January 1867.

<sup>33</sup> *SMH* 18 September 1868.

<sup>34</sup> Certificate from T. Higinbotham, Engineer-in-Chief, Victorian Railways, 32 October 1865. *NSWLA* 17 1867-8, vol. 3, p. 953.



line was nearing an end, was brought in to replace him.<sup>35</sup> Thus it was under Cowdery's supervision that the zig-zag was completed and the railway through to Bowenfels opened on 18 October 1869, just five months after the first train reached Goulburn. Strangely, the very difficulties of the new line to the west helped to create a new traffic, for, as Rae succinctly observed, 'zig-zags, though not so convenient for traffic as tunnels, are more picturesque in appearance'.<sup>36</sup> The Blue Mountains, previously 'scarcely suitable for the denizenship of kangaroo and wallaby', and the extraordinary railway across them, became objects of wonder and the objects of many a pleasure-jant:

Since the opening of the line to Bowenfels, thousands of tourists from all lands have visited these works, and expressed unbounded admiration at the rugged grandeur of the scenery, and the engineering skill and pluck displayed in designing and constructing these stupendous works, which are probably not surpassed on any Railway in the World.<sup>37</sup>

Completion of the railway over the easier, although still undulating and dissected country to Bathurst was prolonged as the contractors proved to be unreliable. In the early 1870s there was another gold rush in the Bathurst region. Although not as spectacular in its effects as the 1850s rush, it did see Hill End briefly become the largest inland town in the colony, and it certainly made it difficult to keep together a workforce to build the railway. Even George Cowdery left the railway for a temporary, but very lucrative career as a mining engineer at Hill End.<sup>38</sup> Opened to Rydal in July 1870, it was not until April 1872 that the next twenty-mile (32 km.) section to Locksley was completed. The contract to the temporary terminus at Raglan, twelve miles (19.2 km.) from Locksley and only four miles (6.4 km.) from Bathurst, was let as early as August 1868, but the first train did not reach Raglan until March 1873.

The Bathurst railway was, in effect, completed. It was another three years before the line was extended over the Macquarie River and into the town as it was necessary to import the ironwork of the bridge from England. This bridge was the second of the twelve iron

35. Mason to Byrnes, 31 December 1867 and 10 February 1868; Rae to Hull, 2 March 1868 *ibid.* pp. 94C, 950-51, 953.

36. Rae *Thirty-five years on the New South Wales Railways* p. 11.

37. Rae *Report* 1873, p. 7.

38. Cowdery, *Life Sketch*.

*The railway across the Blue Mountains created its own passenger traffic. Previously almost uninhabited, the Mountains soon became an antipodean version of Simla or Darjeeling. By 1880 Katoomba already had a substantial passenger station while (in the background) the colony's first great alpine hotel was being built. It opened for business as the Great Western, named after the railway on which it depended. Its luxury and 1,000-metre altitude soon brought vice-regal patronage. The hotel was renamed The Carrington, after the Governor of New South Wales. The building still stands (AONSW)*



HISTORIAN'S VIEW

SOCIAL IMPACT

ironmasters in the Australian colonies to cover their expenses in manufacturing their own pig iron.

There were therefore formidable reasons why so little was accomplished by the companies which attempted to smelt Australian iron ore in the first forty years of Queen Victoria's reign. The depressed price of pig iron caused by the dumping of ballast on the colonial market could be overcome, it seemed, only by three factors: one, the imposition of import tariffs to protect the local primary producers at the expense of the secondary producers; the second, concessional freight rates by sea and by rail; the third, the discovery of some site where the essential raw materials were so conveniently located that the price and uncertainty of production could be substantially reduced.

In the 1870s, Lithgow Valley in New South Wales seemed to offer far more promise than the sites already exploited.

#### 4.2. The development of Lithgow, 1869-1884

Lithgow was created because it had coal in abundance and, after 1869, a railway to the coast running right down the valley. Since several seams of coal outcrop in the steep walls of Lithgow Valley, the early pastoralists in the area were aware of the possibilities. Andrew Brown of Coorwull to the west had mined coal on his estate to feed the boiler of his flour and woollen mill from the 1850s onwards; while Thomas Brown of Eskbank, actually in Lithgow Valley, was exploiting his coal measures by the 1860s.<sup>7</sup> The critical development of transforming this domestic supply into a major industry with considerable capitalisation was the opening of the Zig Zag railway in 1869. In 1869 the Lithgow Valley was a sparsely occupied area, an adjunct to the pastoral area of Bowenfels: by the mid 1870s it was the site of a boom town, completely overshadowing Bowenfels. The rail link to the coast opened by the Zig Zag allowed the movement of heavy goods such as coal to the markets of the coast. Also, as the railway continued to extend inland to Bathurst and to Mudgee, Lithgow was in a critically important position to provide coal to refuel the steam trains on their extended schedules, with no freight charges at all incurred by mine owners.<sup>8</sup>

*by Ian Jack, Assoc. Prof of History, Sydney Uni,  
from his Archaeological Report on Lithgow Blast Furnace,  
see HEM file at I E Aust, Canberra.*

## The Growth of an Industrial Valley: Lithgow, New South Wales

AEDEEN CREMIN

*The archaeology of Lithgow reveals some inconsistencies in the spatial patterning and physical fabric of the town. Upon investigation the variations from the expected pattern can be seen to relate to the personalities of the entrepreneurs. Some saw a profitable investment. Others, imbued with a spirit of 'colonial nationalism', saw it as the arsenal of Fortress Australia. Such attitudes affected the choice and the location of specific industries. We cannot see any structural manipulation of space, such as that recently described at Lowell, Massachusetts, 'designed both to serve the needs of industry and to accommodate America's image of itself as an agrarian republic',<sup>1</sup> but perceive instead a quasi-random location of industry, determined by ad hoc alliances and political allegiances which may have their origin quite outside Lithgow itself. The relics of housing similarly exhibit an inconsistent pattern. They are visibly over-represented in certain chronological periods, under-represented in others. Here too, personalities have to be taken into account: some employers had no interest in housing their workers, some had paternalist views and created housing development, others sold land to get some return on a disappointing investment. This paper presents the growth of Lithgow and the creation of its archaeological record within a framework of industrial growth and decline, expressed in a series of phases, pre-industrial (1839-1868), early industrial (1869-1880), expansion (1881-1890), consolidation (1891-1915), limitation of growth and decline (1916-1939). Dr Cremin lectures in history at the University of Sydney.*

### INTRODUCTION

The key to the town's location lies in the antagonistic attitudes of two men who might, at first glance, seem rather similar: both were named Brown, both were Scottish, from relatively similar backgrounds of small Presbyterian farmers, both came to the colony because of connections formed in their home country and both reached positions of wealth and influence through the manipulation of Australia's burgeoning economy. The difference between them is that the older man, Andrew Brown of Coorwull, saw himself primarily as a pastoralist and patriarch, running an outback empire from his estate at the mouth of Lithgow's Valley, astride the Great Western Highway.<sup>2</sup> He aspired to lairdship, discreetly symbolised by the building of a seigniorial dovecote, more obviously displayed in imposing stone buildings east of the highway, demarcating his territory from that of his neighbour and former employee, Thomas Brown of Esk Bank.

Thomas Brown was 13 years younger than Andrew, whom he met through a connection with John Maxwell, former superintendent of government stock and in the 1830s a landowner at Hartley.<sup>3</sup> Andrew employed Thomas in 1839 to manage the flourmill at Coorwull and to supervise the building of the first part of Coorwull House. Thomas then took up land in the Lithgow valley, on the edge of the Coorwull estate, and on either side of Bells Line of Road, which runs right through the valley. He may have been aware of the potential of the valley's extensive coal measures: it was hard to miss the fact that coal outcropped particularly in the area of Esk Bank. He was certainly quick to capitalise on his investment when the railway line was built in 1869: the railway followed Bells Line of Road, which it joins at Clarence, having up to that point followed the Great Western Highway from Sydney.

With the railway came big-time entrepreneurs who gambled eagerly on the new opportunity: Thomas Sutcliffe Mort, Thomas Saywell and James Rutherford were all men who had already made a fortune and expected to make another in Lithgow. Thomas Brown was ready and waiting: he supplied coal to the railway, sold land where he could, encouraged industry, to which he supplied coal and, astutely, created the nucleus of today's town, by making land available for a hotel, a store, a post office and a courthouse. Andrew Brown, in contrast, did everything in his power to prevent Lithgow from developing. He and his heirs obstinately withheld from sale all the land on the eastern side of the Great Western Highway, which was not surrendered until 1908, forty years after the coming of the railway. The centre of Lithgow is thus located well away from the principal road access and is today reached through twentieth century suburbs.

The patterning of the town can only be understood when it is viewed from the railway. The railway brought money and people, far too many people, for there was already a labour pool of small farmers in the adjacent Hartley Valley, and this pool was greatly augmented by immigration of skilled workers from British mining towns. These workers were never adequately housed, the entrepreneurs displaying in general a total disregard for worker welfare. In time the worker population did increase to the point that it could finance some minor amenities, but Lithgow has been for most of its life a worktown and a man's town, where women and children had literally no place. This was not an inevitable development. Things could have happened otherwise. Had the first entrepreneurs been more concerned with long-term policies; had they provided adequate housing and working conditions, Lithgow could have developed organically and a great deal of suffering been avoided.



As it happened, however, the condition of Lithgow in its early industrial phase, between 1870 and 1880, must have been very similar to the favelas of Brazil today: at the Vale of Clwydd in 1879 'a sort of village or rather hamlet, embosomed in the hills and woods, has here sprung up, the miners' homes in this spot being perhaps less comfortable than picturesque. Their habitations are, for the most part, huts of mud or wood; but some, manifesting an Arab-like independence, apparently prefer to live in tents'.<sup>4</sup>

As time went on, a small population of townsfolk grew up, providing some essential services, such as medicine and banking, or running minor industries, such as breweries or a paint works, or supplying food and drink, but the valley continued to be dominated by heavy industry, coal mining, ironmaking, coppersmelting and large brickworks. Between 1869 and 1890 these industries took up all the space still available in the east and in the northern and southern gullies. Housing was still confined to marginal areas and continued so until the forced sale in 1908 of Coorwull land opened up the present Extension estate, which doubled the town's residential area. It was doubled again by the opening up of the Coorwull and Littleton Estates, when the town reached its present dimensions.

The history of Lithgow's settlement is visible in its street layout and in the architecture of individual buildings. The development of the town can be charted within the industrial phases defined earlier. These phases are of unequal length and are unevenly represented in the archaeological record. Each one represents a stage in the maturing of the town which may seem to be an inevitable outcome of the preceding phase, but which was in reality caused by a complex set of factors prime among which was the personality of certain individuals.

### PRE-INDUSTRIAL (1839-1868)

The first phase lasts from 1839, when Thomas Brown took up his first land grant, until 1868, when Patrick Higgins brought the railway line down the Great Zig Zag into Lithgow valley. Until then the valley was occupied only by four properties: part of Coorwull's 664 hectares (1640 acres) on the west, with Esk Bank's 283 hectares (700 acres) immediately adjacent, and on either side of Farmer's Creek. North of Farmer's Creek was a property called the Hermitage made up of 40 hectares (100 acres) purchased from Andrew Brown in 1844, and of an additional 52 hectares (130 acres) along Farmer's Creek purchased in 1865 by the Revd. Colin Stewart for use as a residence and as a base for his far-flung outback ministry. The last and smallest property was of 40 hectares (100 acres) to the south of Esk Bank and belonged to Patrick Sheedy, a small farmer.<sup>5</sup>

The archaeological remains of this phase are rural and residential. Thomas Brown and the Revd. Colin Stewart had built dignified homesteads, civilised but not pretentious. Esk Bank House and some of its outbuildings have survived and are now preserved as the City Museum. The Hermitage survives only in attenuated form, as one wing of a residence at 7 Coalbrook Street.<sup>6</sup> Sheedy's house is not known but it may very well have been the famous house with the outside *pise* oven shown in an etching and a photograph of the 1870s.<sup>7</sup> The boundaries of the four properties are still visible in the present street outline: the eastern edge of the Coorwull estate is marked by a line between Hassans Wall Road and Sandford Avenue (which also marks the western edge of the Hermitage land). The eastern boundary of the Hermitage is marked by Hepburn Street. The Esk Bank estate boundary ran just south of the line of Pau Street and, to the west, part of the portion boundary survives as Eskbank Street. Sheedy's 40 hectares

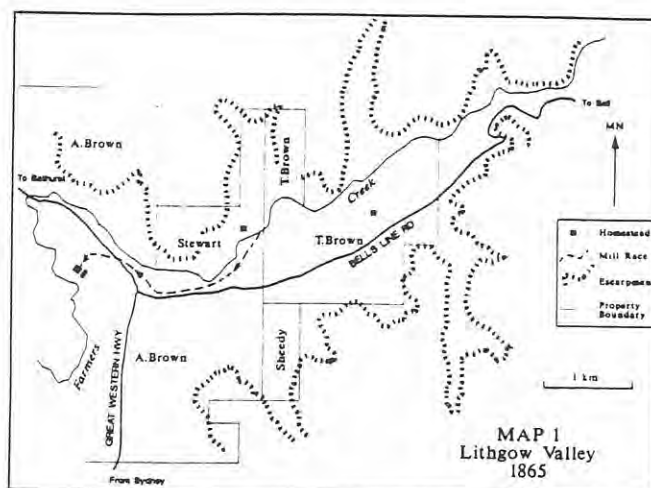


Fig. 1: The pre-industrial settlement of Lithgow.

(100 acres) ended at Shaft Street to the south, the street name recalling the sinking of Higgins' first shaft on that land in 1870. Beyond the valley the remains of the first phase are extensive, including Coorwull House, its stable square, part of the mill race embankment, and the chimney stack for the flour mill, which was enlarged in 1867 for use as a woollen mill.<sup>8</sup>

The first phase is thus very well represented archaeologically and far better, proportionately, than the two succeeding phases, which last from 1869 to 1880 and 1881 to 1890 respectively. These were periods of major industrial growth and land acquisition which profoundly affected the settlement of the valley but have left relatively few traces in the archaeological record.

### EARLY INDUSTRIAL (1869-1880)

The second phase (1869-1880) is now marked principally by the railway line and its industrial sidings.<sup>9</sup> Immediately after the railway was opened in 1869 there was a frantic acquisition of land in order to profit from the coal which was abundant and, in portions of the valley, was easily worked by tunnels or relatively shallow shafts.<sup>10</sup> The first persons to use the coal were, of course, the existing landowners. Andrew Brown had long mined coal for private use and for his mill (converted to steam in 1863), but he never operated commercially. Revd. Colin Stewart allowed coal to be mined from his land by a syndicate of English railway workers (Poole, Woolley and Anderson) first for the use of the railway in 1869, and then as a normal commercial enterprise; this very small mine was initially known as the Hermitage.

Thomas Brown opened two mines at Esk Bank, the first (Eskbank 1) in 1868, about 800 metres north of the line of rail, the second in 1873 just south of the railway. He sold part of Esk Bank's land, north of the railway line, to James Rutherford and his partners, who established the Eskbank Ironworks in 1874. Brown supplied the Ironworks with coal from Eskbank 2 mine, carting the coal over a rail bridge, along the line of Bridge and Tank streets. Simultaneously he supplied coal to the Esk (later Eskbank) Copper Smelter set up by Lewis Lloyd on land immediately adjoining Eskbank 2. The land to the north of Farmer's Creek, adjacent to Esk Bank was acquired by Thomas Sutcliffe Mort, partly as holding paddocks for stock, partly for abattoirs for the Freezing Works, built in 1874-1875. Sheedy's land had been acquired by the railway contractor Patrick Higgins, who up to now had been supplied by the Hermitage and Eskbank 1. He and his partners, who

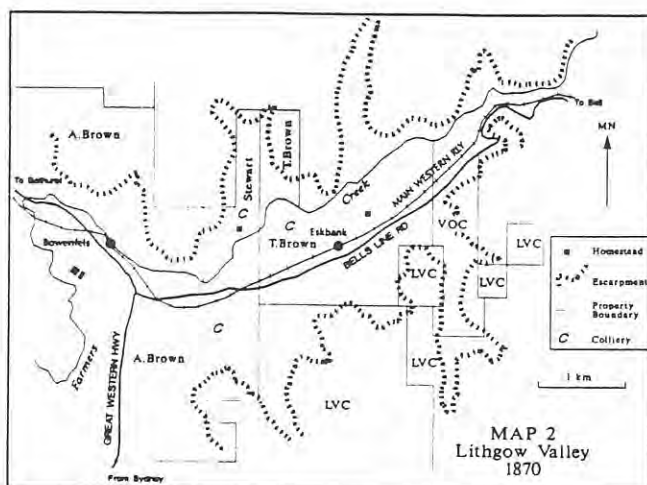


Fig. 2: Early industrial land acquisition in Lithgow valley.

included Dr W.F. Mackenzie, inspector of coalfields and a major landowner in the adjacent Hartley valley, acquired over 400 hectares (1000 acres) of land south and east of Thomas Brown's land, in parcels interspersed with 121 hectares (300 acres) acquired by Thomas Saywell, a Sydney tobacco merchant, in partnership with John Garsed, a local storekeeper. There was some manoeuvring among the partners in these ventures.

Dr Mackenzie seems to have dropped out and Higgins formed a new company, called the Lithgow Valley Colliery, in 1873. His partners were then Thomas Talbot Wilton, John Busby, Edward Gell and Edward Combes (who had some experience of geology from a stint in the French army). Saywell formed the Vale of Clwydd colliery and, independently, set up the Eagle Copper Smelting Company to smelt copper from Eagle Swamp near Bathurst. The Vale of Clwydd (VOC) company remained much the same size territorially, but the Lithgow Valley Colliery (LVC) increased its holdings considerably by buying out most of Colin Stewart's holdings and extending them to the north and east. It opened a new, large, Hermitage Colliery, in direct competition with the first, small, Hermitage colliery, (which had become the Bowenfelds Coal Mining and Coppersmelting Company in 1873). The second Hermitage operated until the 1980s whereas the first had gone out of business by 1884, when it was absorbed into the LVC's holdings.

By 1876, therefore, three of the four landholdings of the first phase had been dismembered, and a remarkable array of new industry had sprung up. Some of these ventures were more viable than others. The copper smelters were not a great success, largely because there was not sufficient ore to keep them going. Mort's refrigeration plant was a failure, for technical reasons unconnected with their location or the quality of Lithgow coal. Despite these problems there was every reason to suppose that Lithgow would go on developing as a major centre of industry.

It is thus all the more surprising that none of the entrepreneurs made any attempt to house their workers or to create a viable town centre. They went further and made it impossible for workers to settle by refusing to sell land.<sup>11</sup>

McInnes has charted the pattern of house sales in Lithgow and it makes depressing reading. At first no land was available at all within Lithgow, though lots could be bought cheaply in Hartley valley. Lots made available in the Vale of Clwydd by the VOC company were not bought by individual workers but by speculators. Some lots were made available in the Vale of Clwydd by the VOC in 1870 and 1878 and the LVC made 65 lots available on its land in 1877 but these seem to have been too expensive to be

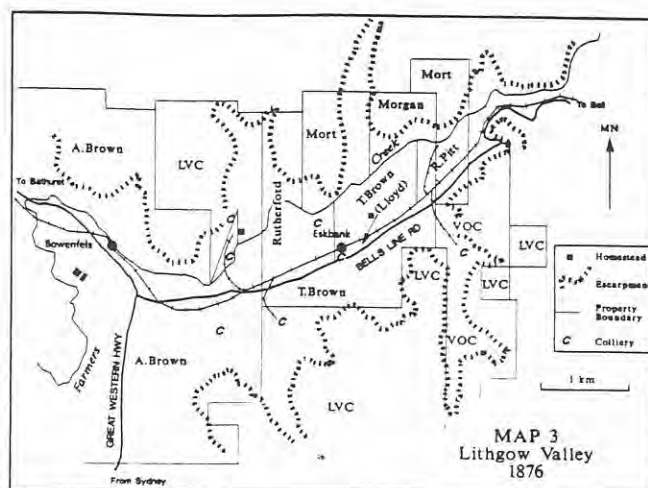


Fig. 3: Diversification of industrial land in the valley: Ruthford is building an ironworks on his land, the Bowenfelds Copper Smelter is being launched on the small triangle of land beside the Hermitage homestead, the Mort's Freezing Works has been erected on land belonging to Robert Pitt (Thomas Brown's manager) and connected to the railway by a rail siding.

purchased by workers. McInnes suggests that the entrepreneurs did not have enough capital to invest in housing. The only entrepreneur who did build was Ruthford who immediately subdivided 28 hectares (70 acres) into 600 allotments. The net result of all this is that there is very little in the way of housing from this period left in Lithgow. The major archaeological remains are those of industry and even these are scant, because of the constant remodelling and refurbishing of the major plants.

## INDUSTRIAL EXPANSION (1881-1890)

The third phase (1881-1890) differs from the second only in that entirely new areas of land were opened up. It resembles it in the optimism of the investors, in the variety of industry and in the lack of interest in worker welfare. Expansion was on the margins of the established industrial centre, to the east all along Farmer's Creek, with first the Zig Zag colliery (1883), then Oakey Park, at the very end of the valley (1885), and last the Vale colliery, facing Oakey Park (1888). The established industries continued to diversify. In 1876 the LVC had opened a Pottery and Brickworks which became an important resource. At the Ironworks Ruthford reopened Eskbank 1 coalmine, which was on his land, and renamed it the Ironworks Colliery. The small Bowenfelds Colliery (formerly Hermitage 1) was swallowed up by the LVC in 1884, to form part of the larger Hermitage 2 mine. Lloyd's Eskbank copper smelter was recapitalised and renamed the Burraga Copper Smelter.

The town clung to a small gap between Thomas Brown's land at Eskbank and the western frontier of Andrew Brown's land to the west. Into this town workers came from everywhere, since access by rail was so easy. There was chain migration of British miners, such as the large group that came out from Silverdale, Staffordshire, in 1886. These miners brought with them not only technical skills but also ideas of union solidarity which were soon put into practice. In general the miners won their case, but the fight was long and bitter. The earliest disputes were not over working conditions but over payment. The miners wished to be paid by weight of coal actually extracted, whereas the owners wished to apply a standard formula to each load. Early minutes of the Eskbank miners union survive and give



details of the debate on weighing.<sup>12</sup> Individual weighing was eventually adopted but not until 1898. The iron industry also had problems, right from the start, and these continued to exist during the life of Lithgow as an iron and steel town.

There can be no doubt that the new owners were not concerned about workers' welfare, any more than they were concerned with creating a town centre. This attitude contrasts very much with that of the earlier landowner, Thomas Brown, who had donated a Presbyterian church and made land available cheaply for a School of Arts and for institutional buildings such as the courthouse and post office. Other church buildings were paid for by the congregation, which was mostly of employed miners and other industrial workers. To that extent, Lithgow is very much a town built by the people for the people.

There was not a total dearth of building investment, however. Hotels increased from one in 1874 to four by 1879 to eight by 1888. In 1888 there were three Assembly Halls, the School of Arts, a Jockey Club and six different religious denominations, for a population of 3500.<sup>13</sup> The pubs were splendid, as was one of the churches, St Paul's Church of England, built by Edmund Blacket (replaced in 1930).

The halls are to this day a very striking feature of Lithgow town. Some were religious, but most were of benevolent societies.

Along with a centre, Lithgow was acquiring, for the first time, a set of townsfolk, whose livelihood came from the town, not from its surrounding industries. They were the publicans, professional people and government employees. They resided on the fringes of the valley or in the town itself. Because of the Cooerwull estate's stranglehold on the western half of the valley, large plots of land were almost unavailable, even for the wealthy, so that Lithgow's emerging bourgeoisie was never concentrated in any particular area.

Twenty of these new burghers proudly display themselves in the pages of the *Aldine Centennial History*. They are much of a muchness, self-made men, mostly born outside Australia, who are ending adventurous lives in what is clearly perceived as a town that cannot fail to prosper. Interestingly, though these gentlemen are keen to claim membership of the Masons, the Good Templars, the GUOOF, the RAOB, the IOOF, MU, UAOD, and, always, the Jockey Club, only one of the twenty worthies lists church affiliation; the owner of Tattersalls Hotel was also treasurer of St Patrick's Church. Clearly the self-image is of solid, conscientious but jovial men who have seen the world and know what's what. Their occupations are of some interest: auctioneer, chemist, company director (LVC), paint manufacturer, tailor, bank manager, storekeeper (2), cordial manufacturer, landowner (Cooerwull), soap manufacturer, butcher (2), physician (2), publican (2), brewer, manager (VOC), and builder, constituting a pool of skills and resources in Lithgow which could hardly have been imagined ten years earlier.

Lithgow boomed during the period 1880-1890. It was incorporated as a borough in 1889, Main Street was graded in 1890 and in that year cheap housing land became available on Mort's Estate, north of Farmer's Creek. The population doubled and housing stock, though still inadequate, at least improved in quality.

## INDUSTRIAL CONSOLIDATION (1891-1915)

The following two and a half decades, 1891-1915, constitute a fourth phase of consolidation, within the parameters which had by now become clearly defined. The pattern had been set, both spatially and socially, and this phase is

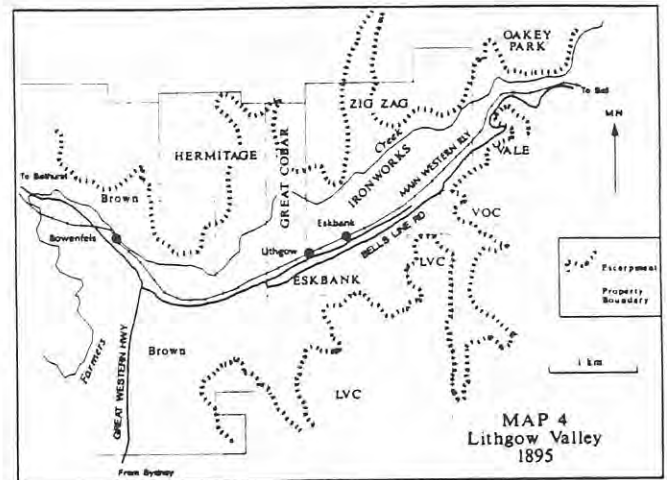


Fig. 4: Consolidation of industrial land in the valley: the collieries have now spread to the eastern end of the valley and into the northern gullies. Thomas Brown's land north of the railway has been acquired by Sandford's Ironworks, while part of the Ironworks land has been sold to the Great Cobar Smelter.

essentially one of building upon the achievements of Phases 2 and 3.

The town was growing and becoming more sophisticated. By 1900 there were nine hotels, three banks, a municipal water supply and gaslights in the main streets. The population increased by a half between 1901 and 1911, from 5628 to 8196 and the pressure on housing was still intolerable, despite the subdivisions in 1895 of the Hermitage and of some of the Ironworks land. A sustained campaign by John Ryan, editor of the *Lithgow Mercury*, culminated in the forced sale of some land from Andrew Brown's holdings. This released 110 allotments in what is called the Extension Estate, just east of the old town centre, but it hardly satisfied the demand. Rents continued to be high and in 1911 still only 31 per cent of residents owned their dwelling.<sup>14</sup>

In industry there were some failures, notably that of the decorative ceramics at the LVC Pottery, but mostly the outlook was good. The major developments were in the metallurgical industries. A new copper smelter, the Great Cobar, was erected on land east of the Ironworks in 1895. Getting the Great Cobar to settle in Lithgow was the achievement of two men, John Ryan of the *Mercury*, and the remarkable Joseph Cook, a Silverdale migrant and trade unionist who had a brilliant if bizarre political career, rising to Prime Minister in 1913-1914.<sup>15</sup> In 1895 he was the local State member and Postmaster General but he left the area in 1901, to enter a career in Federal politics, in opposition to Labor.

Cook was, or became, a staunch supporter of the British Empire, displaying an attitude which was perceptively dubbed 'colonial nationalism' by the British writer Richard Jebb.<sup>16</sup> This attitude was shared, enthusiastically, by Lithgow's most prominent industrialist, William Sandford, manager and owner of the Ironworks, the man who created Australia's modern iron and steel industry.<sup>17</sup> Under his management, Lithgow became a steel town, heavily dependent upon government protection and contracts, but nevertheless a notable example of Australian self-sufficiency. Sandford had been much impressed by the Boer War and was also quick to see the consequences for the steel industry. In 1901 he was pointed out that Australia was far too dependent on imported goods.

He was satisfied that, before many years were over, Australians would have to take up arms and defend their shores against a common enemy. Could we make a ton of iron or ship-plate or a pound of powder? We had seen that

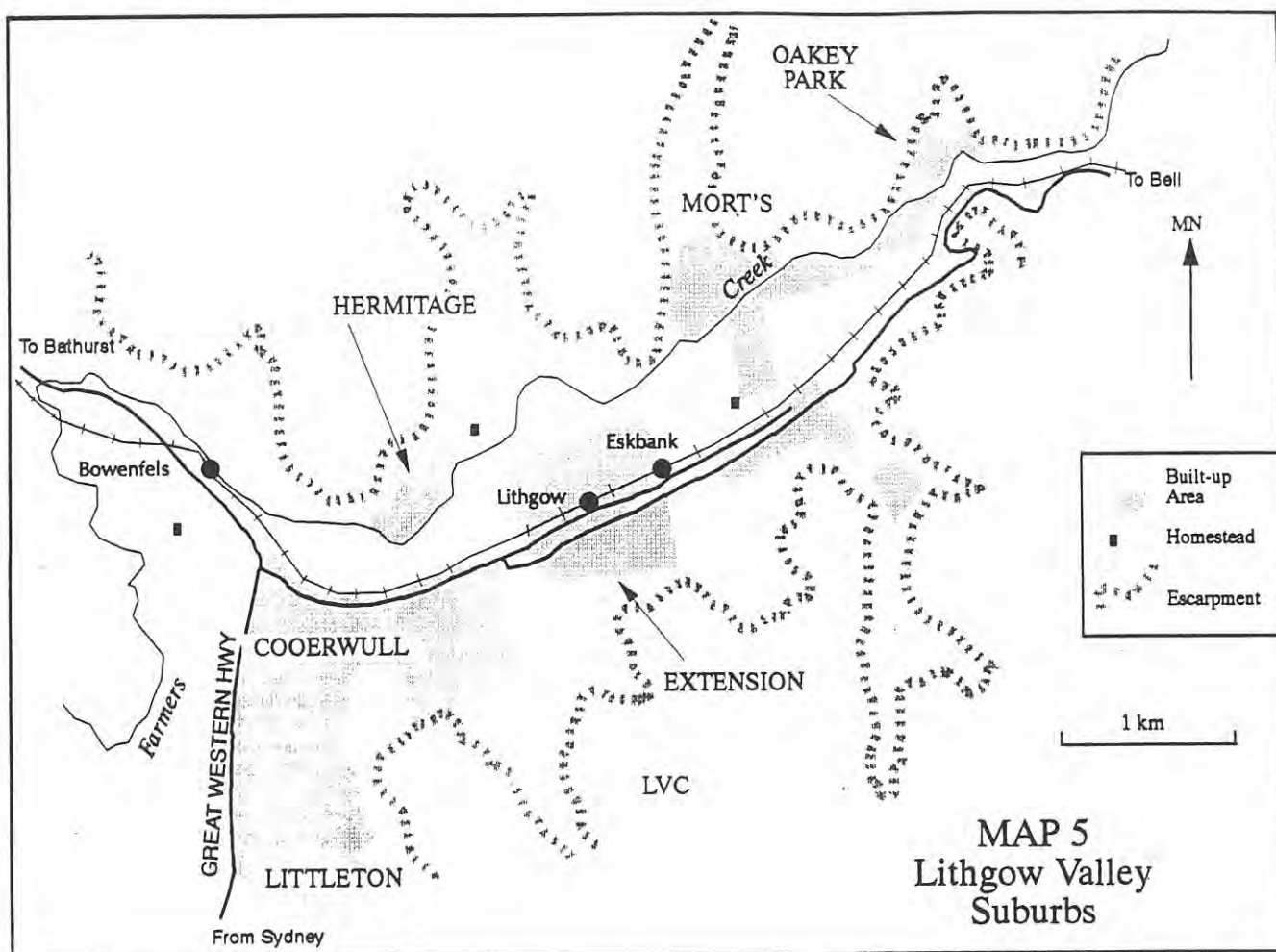


Fig. 5: Development of Lithgow's residential area by the opening of land to the north and west in the period 1890-1915.

Australians were as good fighting men as any in the world, but what was the good of a man without weapons?<sup>18</sup>

Sandford's views on defence rested upon the strategic location of Lithgow in whose potential he had an almost mystic faith. His opinions are echoed in the remarkable plea to have the Australian capital located in the Western district of New South Wales. The West, with Lithgow's seemingly inexhaustible resources of raw material, was seen as the ultimate fortress.

The presence of coal at Lithgow would help to establish the Capital as a self-sustaining centre. The fall to an enemy of Sydney or Melbourne is a remote but not an inconceivable contingency. A Capital in the West, self-sustaining, would be invulnerable, whether viewed as arsenal or fortress.<sup>19</sup>

In fact the resources were far from inexhaustible. Iron ore and limestone (used as a flux) were actually running out. The clay was excellent and there were four brickworks, including Newbold's Silica Brick, but the coal was unsuitable for coking and thus useless for smelting. This sad fact did not really become apparent for a long time.

True, the Vale coke ovens had closed very quickly, but they were so crudely built that was hardly surprising.<sup>20</sup> Two sets of coke ovens were built at Oakey Park and this coke was used in the Blast Furnace which Sandford built in 1906-1907. The Blast Furnace bankrupted him, but he had nevertheless achieved his dream of smelting iron from native ores. In 1908 his wishes for a strategic centre in Lithgow were realised by the acquisition of land from the Brown estate for a Small Arms Factory. It is probably not a coincidence that Joseph Cook was then Minister for Defence.

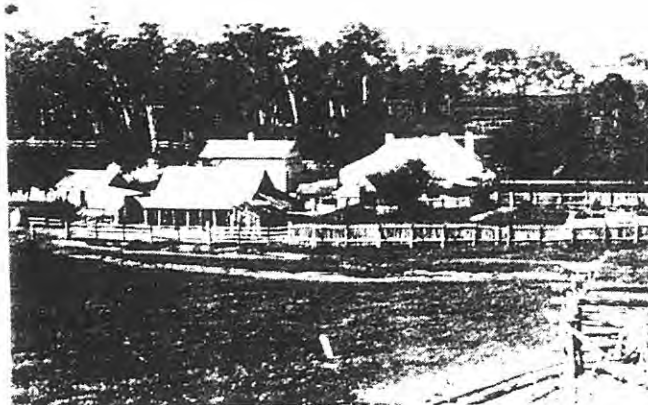
The Small Arms Factory was to save Lithgow from the impending economic catastrophe. In the 1910s, as throughout the earlier period, entrepreneurs were undercapitalised and the workers' conditions were poor. Dissatisfaction was most noticeable at the Iron and Steel Works, where the Hoskins Brothers, who had succeeded Sandford, were trying to bring in new work and pay systems. In Sandford's time the workers had been paid in a rather erratic system of piece work. Sandford's views on this are worth quoting, as examples of his management style:

"The problem of capital and labour was a great one, of whether men should get the proportion of what they earned. He had taken a certain position in Lithgow and it was not a question of whether a man got two, three or five pounds per week, but what he earned. That was the question we ought to go into and that can only be done by an Accountant. As far as he was concerned, his Accountant would answer any question that the men working for him chose to ask". (1901)

Mr Sandford declared that individual effort, on the part of workmen and employees generally, should be more fully rewarded, and said he favoured the south Staffordshire system — contract piece work, with sliding scales of pay according to the amount secured for the product — rather than set wages. (1922)<sup>21</sup>

The Hoskins were appalled by this system, which actually had not worked too badly, in that there were relatively few strikes at the Ironworks. The new regime was confrontational and disputes became frequent, culminating in the nine-month long strike of 1911.<sup>22</sup> However, both Sandford and the Hoskins did make land and houses





*Fig. 6: The Hermitage homestead c.1880 with the shaft of Hermitage No. 1 mine at the bottom. This view, taken from due north, shows how much open space still existed in industrial Lithgow; the only two visible structures are the 3-arch rail bridge (now opening onto Albert Street) at right of centre, and the gothic-style house (now 24 Lithgow Street) built by Edward Gell, the LVC manager. (Photo: Museum of Applied Arts and Sciences)*

available for the workers, and the Hoskins donated a library and a church to the town. In that respect the owners in the fourth phase differed very much from those of the second and third phases.

The fourth phase is the best represented in the archaeological record. Most of the older buildings in the town centre and the little that is left on the industrial sites belong to this phase. The major relic is, fittingly, the Blast Furnace site, and its reservoir, Lake Pillans, but there are also the Vale coke ovens, most of the Oakey Park colliery, the Zig Zag Brewery, the few structures left on the LVC and Hermitage collieries, part of the Small Arms Factory, and a great deal of the workers' housing.<sup>23</sup>

The reason for this high retention rate, which was much higher until the wave of demolitions in the 1970s-1980s, is that Lithgow's industry slumped after the First World War. During the war it was sustained, as Cook and Sandford had foreseen, by the steel and coal industries, the arms manufacture and, remarkably, by the Coorwull Tweed Mills, still going strong and producing cloth for the military.

## **LIMITATIONS OF GROWTH AND DECLINE (1916-1939)**

Once the war was over the economic reality became very plain. The only new industry was the State Coal Mine, which worked briefly in 1916-1917 but did not really get going until 1920. Charles Hoskins opened the Steelworks Colliery in 1926 after building coke ovens for the blast furnace in 1915-1916, but he had already bought into the Illawarra, where the entire Lithgow plant was transferred in 1929-1932. In the 1930s, during the Depression, only the collieries operated and even then sporadically. Zig Zag closed in 1933 and Oakey Park in 1939.<sup>24</sup>

The archaeology of the inter-war period is represented by parts of the State Coal Mine and by the Hoskins coke ovens, of which extensive foundations survive along the railway east of Lake Pillans, and by some fine housing in the areas around the Small Arms Factory, in the Coorwull and Littleton Estates. The archaeological remains of the Depression are of public works, such as kerbing and guttering and the landscaping of the Gilanmire Reserve, which occupies the land through which Andrew Brown's mill race had run a hundred years earlier.

The population had peaked in 1929 to a total of 18,000 persons, making Lithgow the fourth largest town in New South Wales, after Sydney, Newcastle and Broken Hill. These people were still not adequately housed and there were very few public amenities. Such open space as there was rapidly turned into shantytowns as the homeless unemployed gathered.<sup>25</sup> The solidarity of the people of Lithgow during these hard times is remarkable and has done a lot to foster a particular image of 'the spirit of Lithgow', compounded of resentment and the will to battle on. The resentment is on the whole justified, while Lithgow could probably never absorb the available pool of labour, the workers were certainly hard done by in terms of living conditions. Had adequate housing been made accessible in the early stages the hardship of the Depression would have been lessened, at least for the local people.

The Second World War aggravated the housing situation, even though it created employment at the S&AF and at the collieries.<sup>26</sup> The housing which had run down completely in the 1930s simply could not accommodate the incoming labour force, and housing was never really adequate until the 1950s, at which time major changes in coalmining methods created many redundancies. Five collieries closed between 1957 and 1963 (Cobar, Eskbank, VOC, State and Steelworks).

## **LITHGOW TODAY**

Lithgow has changed very considerably since the 1950s. It is now being absorbed into the western fringes of the Sydney megalopolis. Heavy processing industry is long gone and has been replaced by light manufacturing industry. Property prices are rising and rents are high. As the town gentrifies, a positive symbolic value is for the first time being placed on the industrial heritage. Till now the attitude of the people of Lithgow has been, very understandably, that the industrial heritage represented a period of oppression and degrading work from which they wished to dissociate themselves. There was a wave of municipal destruction in the 1970s and early 1980s which swept away the Zig Zag Colliery winding house, the Scenic Brickworks chimney and almost all of the LVC complex. The Blast Furnace engine house survived largely through civic inertia. The loading areas for the Hoskins coke ovens and the Hermitage Colliery buildings have recently been quite unnecessarily vandalised.

In contrast some sites are now receiving long-overdue attention, to some extent because they have some tourist potential. As part of city conservation programmes, three sites are being presented to the public. The Blast Furnace site has been landscaped, the Oakey Park wooden head frame is being stabilised and landscaped, and plans are in hand to make the State Coal Mine into an industrial museum. Both the coal mines are in areas of great natural beauty and the Blast Furnace engine house has a distinctively monumental quality. The three sites are thus essentially perceived as aesthetic items and are being so treated. This style of presentation reflects not only the vision of our own time, but also the message that the past is now safe to handle.

A particular message for the archaeologist is that these remains have survived partly by accident, but their preservation is coming about through a 'happy accident' which is clearly displayed in the remodelling of the industrial past. The structures reflect Lithgow's chaotic, unplanned growth and decline but their deliberate preservation reflects Lithgow's integration into metropolitan culture. The artefacts of preservation (signage, landscaping) are thus powerful archaeological markers in their own right.

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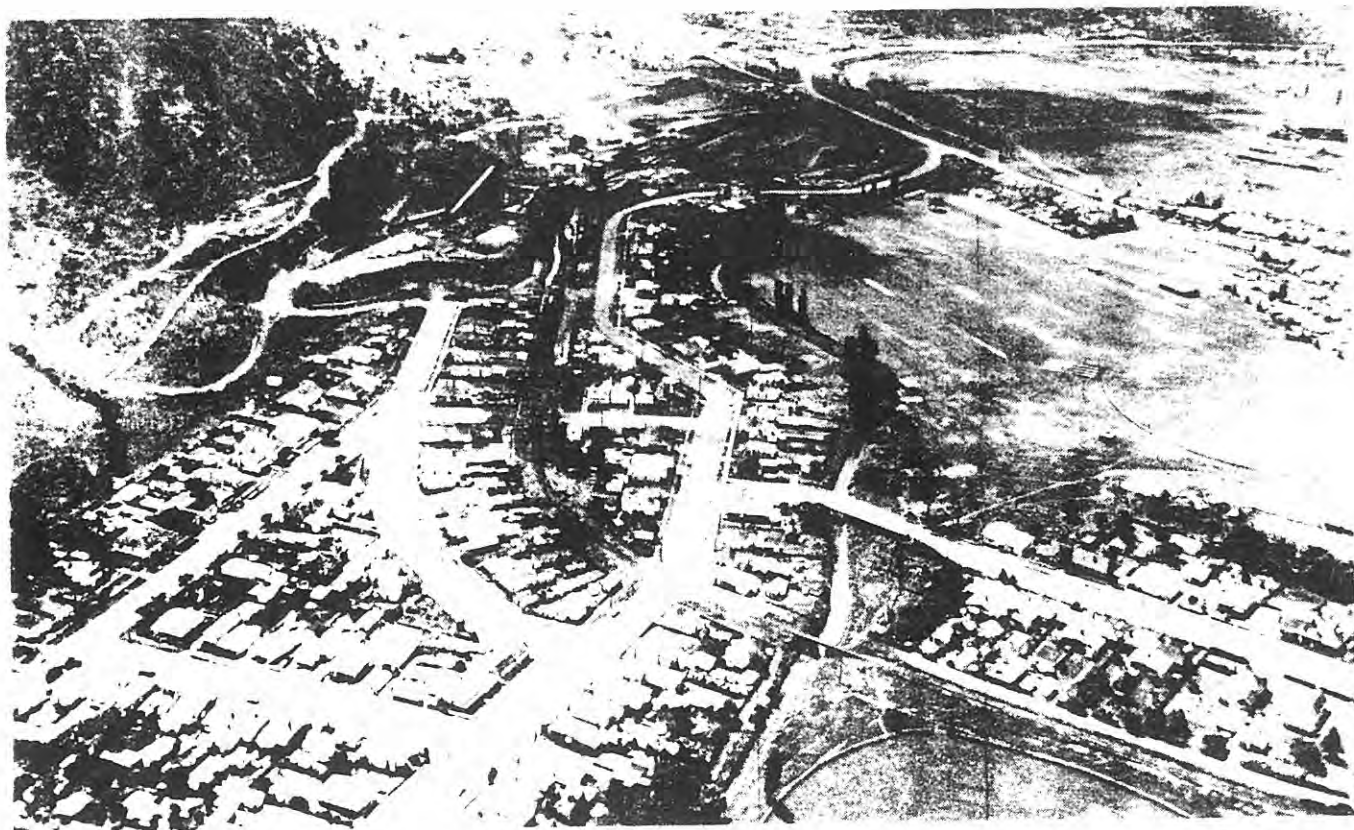
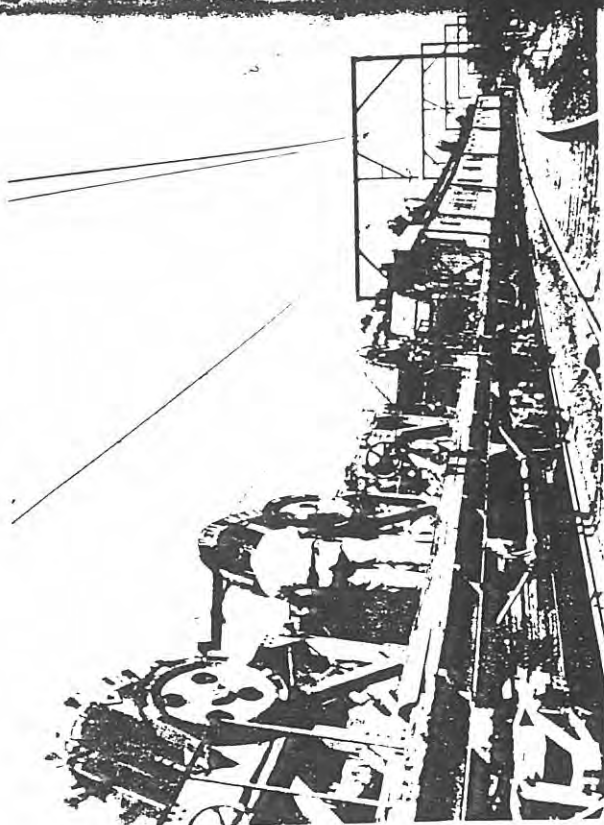


Fig. 7. An aerial view of the Hermitage in the 1980s, from due west. The Hermitage colliery is at the left, and beyond it the still sparsely inhabited area of McKellar's Paddock. The Hermitage homestead now 7 Coalbrook Street is between the colliery and Farmers Creek, which also separates the Hermitage Estate from the open space of the Glanville Reserve and the vacant land of the former Ironworks Estate. (Photo: NSW Mining Museum)



#### EXTENDING ELECTRIFICATION

Members of the Society will be interested in the above illustration. It shows the installation of contact wire from a work train on the Hornsby to Gosford electrification.

Excellent progress has been maintained on this work. The first section, from Hornsby to Trowan, was completed and opened for electric traction on Sunday, 16th November last, i.e., six weeks ahead of schedule. The target dates for completion to Hawkesbury River and to Gosford are the end of June and December of this year.

Like the electrification on the Western line to Lithgow, the Northern line electrification to Gosford will provide faster, cleaner and more comfortable transport for train passengers.



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**THE AUSTRALIAN RAILWAY HISTORICAL SOCIETY**

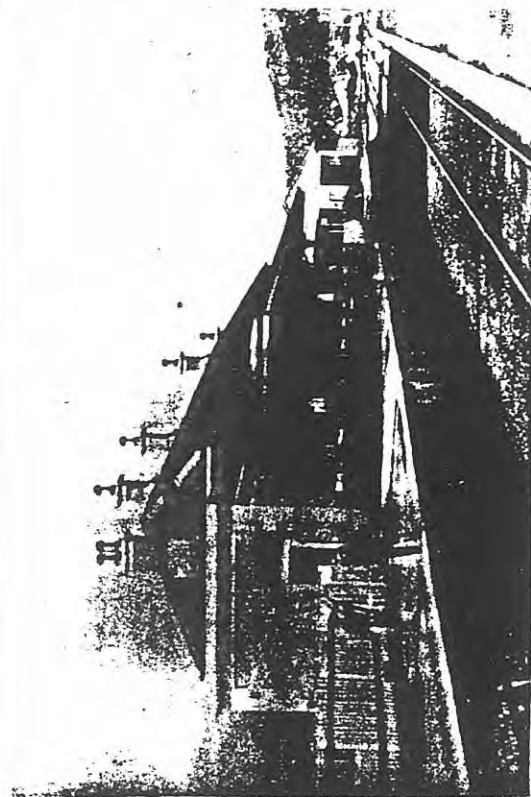
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The first substantial station in the Lithgow area was opened with the new goods depot and yard (now Old Yard) on the 1st March 1862 and was named Eskbank. This view is looking towards the East and shows the fine brick building on the up platform. With the opening of the present, more centrally-situated Lithgow station in 1925, the Eskbank station was closed to passenger traffic and renamed Lithgow Goods Station.  
(Photo: New South Wales Railways)

#### ✓ THE RAILWAY CROSSING OF THE BLUE MOUNTAINS (by R.F. Wylie and C.C. Singleton)

(N.S.W.)

#### 7 - Lithgow

Looking down on the Lithgow Valley today from a vantage point on the Scenic Road near the locomotive depot, it is hard to believe that this centre of the western railfields, proclaimed a city in 1945, did not exist when the railway reached Bowentel's in 1869.

The only signs of settlement were the

two pastoral holdings of Thomas Brown of "Eskbank House" and Andrew Brown of "Georgetown". The latter had interested himself in industry to some extent, for he mined coal in 1848 for his flour mill, later changed to a woolen mill in 1857. J. J. Pool mined coal in 1860 on the Hermitage Estate, as also did Thomas Brown in 1869.



The nearest centre of population, though very small, was Bartley on the River Lett. But there was a certain scattering of houses under massive walls at Old Bowenfels, a mile or so from the railway but actually outside the Lithgow Valley itself.

There were neither stations nor sidings between Mount Victoria and Bowenfels at the time of the opening of the extension from Mount Victoria.

Descending at 1 in 42 from Bottom Points the line passes over a fine 10' stone culvert in high bank and reaches the floor of the valley, where it eases to a long easy grade of 1 in 150, terminating for the time being just before crossing Farmers Creek. There was a 10' stone arch opposite Vale of Cleyd and a three 20' arch stone viaduct, now carrying Albert Street, diversion in place of the original waterway.

**Rapid Development of the Valley**

With the gift of motor transport of a cheaper nature than obtainable previously, the rich coal and clays in the valley were soon exploited. Industries sprang into life so quickly that at the end of 10 years, the following rail sidings had been opened to serve the local industries - T. Brown's Esk Bank Colliery, 1875; Bart's Freezing Works, 1875; Lithgow Valley Colliery, 1875; Vale of Cleyd Colliery, 1874; Bowenfels Colliery, 1874 and Eskbank Ironworks Company, 1875.

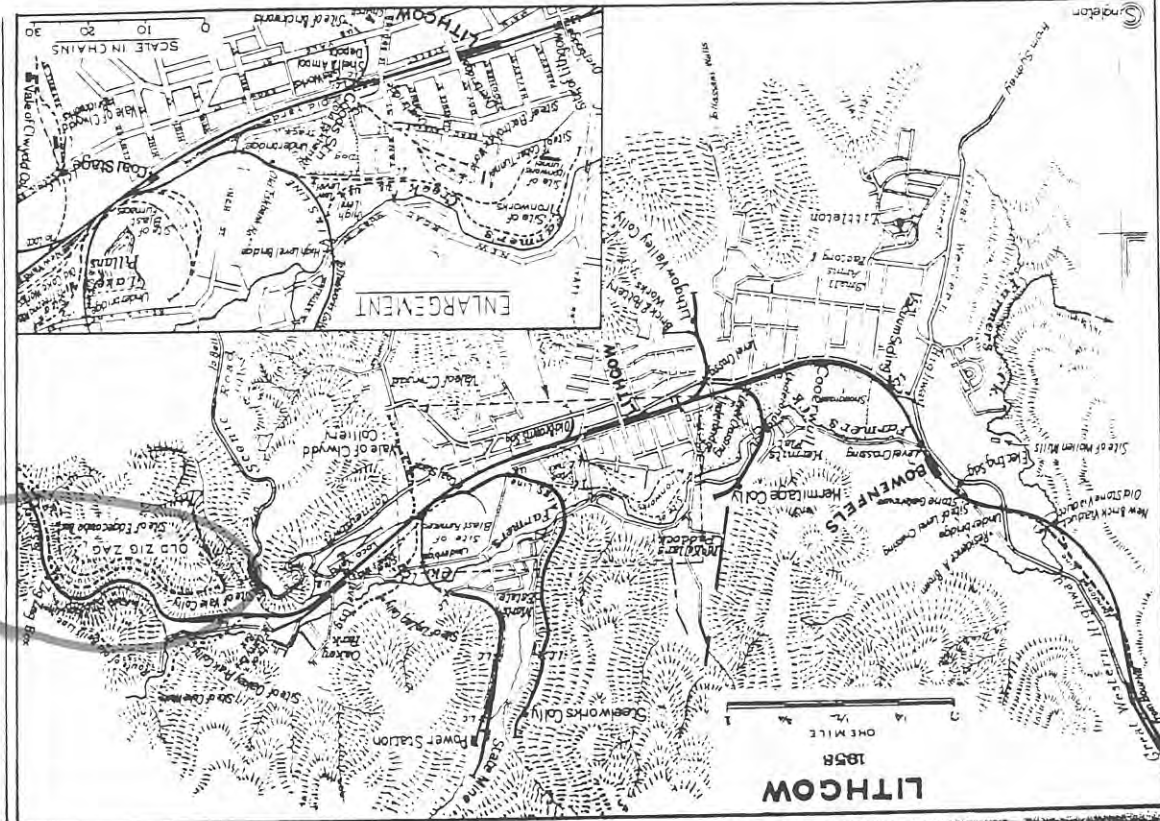
By 1879, a population of 3000 had gathered around the industries and, in 1889, it had increased to 4000 and the town had been incorporated. In 1919, the town's population was 14,000.

**The Passenger Stations in Lithgow**

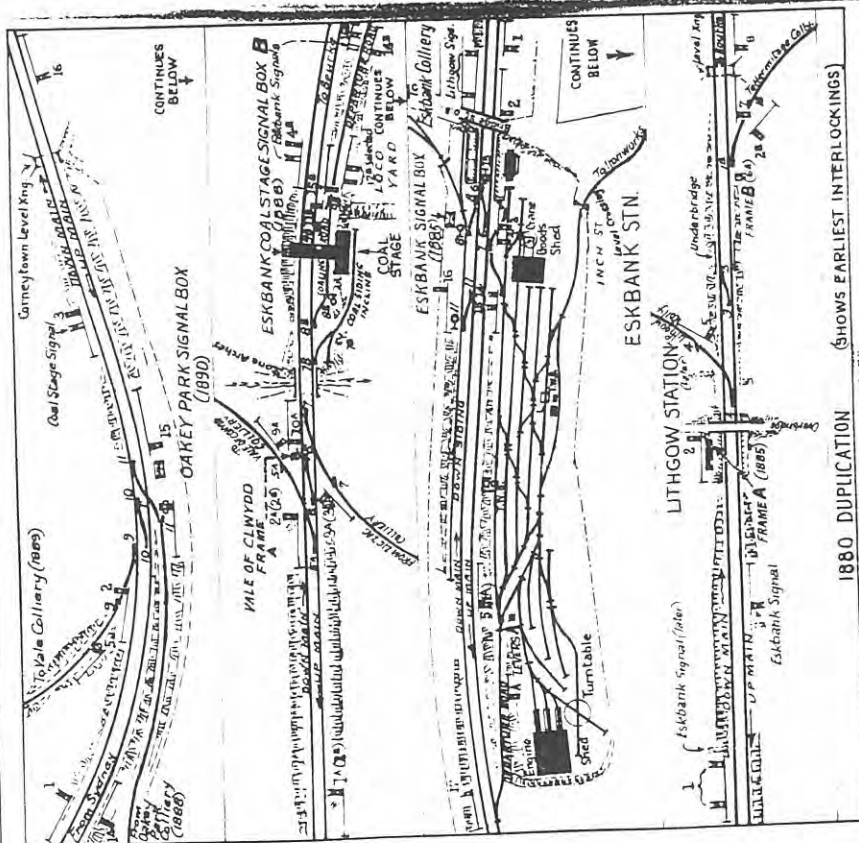
The first mention of a passenger stopping place, in addition to Bowenfels, is to be found in the working timetable of 4th February 1875, being Brown's Siding, a conventional stopping place. It was a small timber platform, situated near Brown's Eskbank house. The actual site is uncertain but Brown's residence still stands near the Eastern boundary of the dog track.

In August 1876, it was renamed Esk Bank, to remain as an unattended platform until the completion of the depot yard and station on the 1st March 1882, which was named Eskbank. The 1882 duplication was opened before the completion of the new station and the additional track was taken behind the platform, making it a small island in the meantime.

In June 1877, a timber unattended platform, called Lithgow, was brought into use at the foot of Station Street but, in August 1879, a station building was added and a facility for crossing trains. The records mention that the ladies' room was not completed before the main building was opened.







1880 DUPLICATION (SHOWS EARLIEST INTERLOCKINGS)

into use on the 1st March 1882.

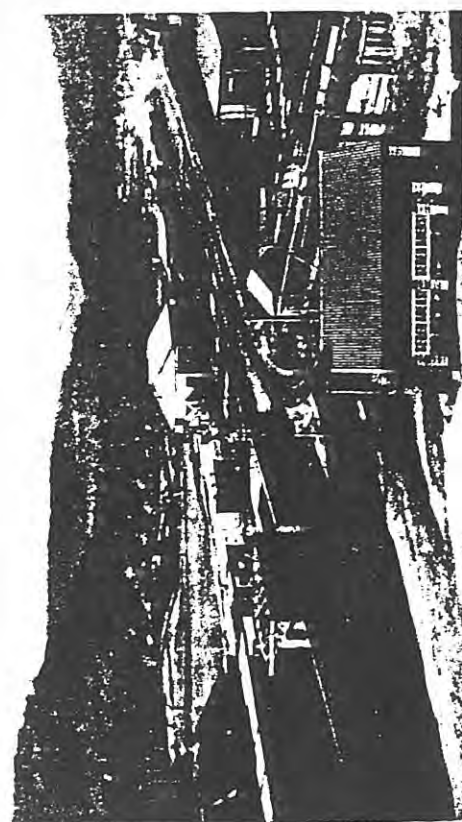
The branch off North's Siding to Zig Zag Colliery was opened in 1883, Oakey Park Colliery siding was opened in 1888 and the Eskbank Coal Stage, a unique arrangement that spanned the two main lines in addition to a level, coaling road, in the same year.

A signal-box was opened at the junction of the Oakey Park spur on the 11th April 1890 and it also controlled the Vale Colliery at line points, opened the previous year. Absolute Block working replaced the Telegraphic Block between Bottom Points and Rowentels on the 30th June 1890. The accompanying diagrams show the arrangements on the duplication as they existed at that date and with minor alterations for the next 17 years.

**Stations and Sidings on the Duplication**

It seems fitting at this stage to review the various station arrangements as, with the exception of Rowentels, no records can be found covering the period earlier than 1890.

Oakey Park was a block signal-box, high up above Farmers Creek, established for the purpose of operating the junctions to Oakey Park Colliery and Vale Colliery sidings. With due homage to British Board of Trade Regulations, both collieries had trailing connections only to the down main line, with a single trailing "main" crossover between. This made the double shunt involved the more difficult as the line was on a 1 in 42 grade.



Eskbank Station and yard about 1892-3. In the foreground is Brown's Siding, brought into use in 1872, leading to the Esk Bank Colliery, whilst in the background, on the other side of the cleared paddock, is Thomas Brown's 'Esk Bank House', just visible among the trees. (Photo: N.S.W. Railways.)

The fact that the empties were propelled up from Eskbank yard reduced the risk of breakaways. The box was only opened when required to work the collieries.

Vale of Clwydd was an enclosed lever frame, operating the main line connection with the Vale of Clwydd and Zig Zag collieries, lines which, like the previous example, had trailing connections in the respective main lines, together with the main crossover.

The main-line signals were controlled from the Eskbank Coal Stage signal-box, which was close by.

Eskbank Coal Stage was the name of a block signal-box, which was situated on part of the structure spanning the two main lines with hatches for the coaling of tenders beneath. The stage also crossed over the Engine Coal Road and had side bunkers with loading shoots for the last-named track. The signal box, because of its position, was always in a lanky state and was originally provided to control the exit from the yard for up trains, coaling of engines to and from the steam shed and points of the steeply graded coal road to the high level stage.

Eskbank Yard (now Old Yard). The yard was on the up side, with five sidings and intermediate crossovers and was level. As the main line ascended towards Sydney at 1 in 150, the yard was well below it at the coal stage end, so that there was a steeply graded single line connection, at 1 in 40, leading to the up main, when first opened, this was by trailing points and weighted lever, protected by signals worked from a ground frame, but later, the new Coal Stage signal-box controlled the exit. The engine shed was at the Sydney end of the yard in the excavation behind the coal stage. On the down side, there was a long dead-end siding connected with Brown's Siding.

Eskbank Station has already been described.

Eskbank Signal-box was a block signal-box controlling the main line connections of the Bourke end of the yard only, today, is known as Lithgow Goods Yard Signal-box.

Lithgow Station was at the roof of Station Street, under the overbridge now level-

ing to Sanford Avenue. The main building's siding was on the down side, only a small building shed existing on the up side. The main building was on the down platform and, in addition to main-line signals, operated trailing points in the up main. For Lithgow and the main crossover, with key for the Colliery and a main crossover, the ground frame to Hermitage Colliery junction, which also had trailing points in the up main, the block was only switched in to shut the collieries, and there was little passenger business—Baskbush Station was opened.

## The Industrial Sidings

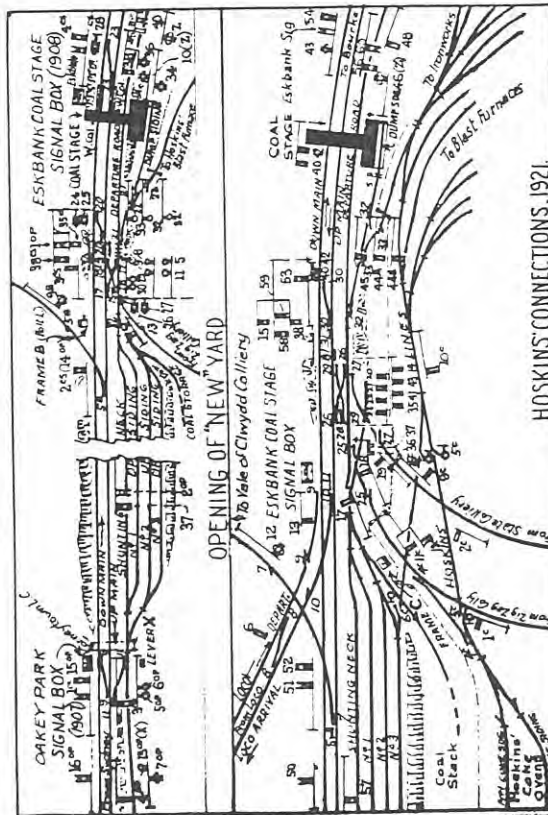
The mine's new Zig Zag shaft was opened on the 1st May 1932 to serve the new Vale Colliery, which was situated on the down side in the narrow valley that lies between the cliffs on either side of the old Zig Zag on one side and the second road on the other. It proved to be faulty on several occasions when the mine bottom's became the target for one or more of the trucks, inadvertently sending the Fox-Pont's dead-end.

The siding was about 34 chains in length. It was in a direct connection with the down from its trailing connection with the main line. A shaft, 33 ft in depth, delivered coal to the screens, which were over two loop siftings, while empty trucks were pushed up the arrival road, by-passing the screens, to the dead-end, from where they were gravitated down to the screens as required. A railway delivered coal to an elevator, which passed over the siftings to coke ovens. The colliery was closed in 1900 and few signs remain today.

remain in today. Oakley Park Colliery siding was opened in 1866 and had a life of 53 years. On the up side of the line, it was situated on the North bank of Farmer's Creek, almost opposite the old Top Points of the Zig-Zag. As originally constructed, the branch was 58 chains in length, having a connection with the main line facing up tracks. Descending steeply from the junction, it crossed Bell's Road on the level and then across a bridge over Farmer's Creek.

Farmer's Creek. A shaft, 44 ft in depth, delivered coal to screens over two long sidings and empties were pushed up the arrival road into the dead-end for gravitation to the screens as required. Some time after 1904, the bridge over the creek was widened to take two rail tracks, a third line was taken under the screens and the dead-end was extended six chains further up the gully to end between two coke platforms near the coke ovens. These last named formed quite a feature of a night trip over the Big Zee, when seen from Top Point, as their glare lit up the valley below.

below, with the completion of New Yard, the branch was extended to connect with the shunting neck of the yard on the 11th Decem-



## HOSKINS' CONNECTIONS 1921:

liery set-up and the railway connection was no exception. The branch was opened in October 1920, the first coal being won on the 15th December 1921. The name was changed to Railway Coal Mine on the 1st December 1929. The Railway Department was greatly relieved when the colliery was transferred to the Department of Mines on the 1st December 1932 and it was renamed the State Coal Mine.

The single line branch is lin. 40c. in length and leaves the Bourne end of New York on the up side to turn northward, passing on the up side of the bridge, crossing the weighbridge loop before crossing Lynch Street on an underbridge, followed closely by a second bridge, which crossed over Farmers Creek. It then turned west and later north into Hart's Gully, passing over a level crossing, with a second level crossing just before entering the colliery yard, which is much larger than any found in the western coalfields. The shaft delivers coal to the screens, which cover no less than five long loop sidings. Empties are pushed up the arrival road to a single dead-end and are then re-rigged to the screen roads.

The Power House Siding was laid in just shortly after the opening of the Belmont-Tal Colliery Yard to serve the then small plant and the later construction of the various stages of the large installation in use today. It adjoins the State Mine yard and the connection is with the colliery arrival

ber 1917, and thus freeing the main line from the isolated junction. The mine was closed in September 1941 and all plant and installations removed.

buildings removed. The Zig Zag Colliery Siding was situated on the line, the colliery being situated on the north side of Farmers Creek. The first of this branch siding was opened in opposition of the site of New York. The first section of this branch siding was opened in 1871, to serve the freezing works of Thomas Mort, which he constructed while pioneering his ship refrigeration project. While it was the first example of the transportation of frozen meat for export, it was not a success, but laid a solid foundation for the industry in later years. The works closed in 1881. They were situated on the Southern side of Bell's Road and were eventually taken over by Luby's Brewery, having been sold as early as late as 1904.

The siding left the main line by a junction having no trains near the site of the present coal stage. In 1871, Thomas Saywell opened the Zig Zag colliery and built a line from the 1<sup>st</sup>-chain peg, on Mort's Siding, crossed Bell's Road on the level and bridged Farmers' Creek to the colliery, the dead-end being 50 chains from the points in the main line. The coal was delivered from a shaft, 270' in depth, to screens over two loop sidings. There was a loop siding across Bell's Road for empties. On the 1<sup>st</sup> May 1906, the junction was transferred to the departure road. After the mine closed down, the siding was put out of use on the 13<sup>th</sup> March 1921, and all cart of iron ore.

1933 and all plant removed. A Vale of Gwynedd Colliery Siding was opened in July 1974 and served a mine on the down side of the line in the mouth of the Vale of Gwynedd, off the Llangow Valley. The siding connected with the main line with points facing down trains, a few chains on the Sydney side of the site of the Coal Stage and crossed Cornetown Road on the level, terminating at a distance of 44 chains from the junction. A shaft, 240' deep, delivered coal to the screens, over three loop sidings and empties were pushed up the arrival road to the dead-end for gravitation to the screens.

Some time after 1934, a loop siding was built enclosing the brickworks associated with the colliery, also crossing Garney town road on the level. The mine was closed in 1950 but the firm used its siding for loading coal from road lorries until 1957, when the siding was removed. The brickworks associated in 1951.

State Coal Mine Branch. Governments do strange things and one example at Lithgow, when it instituted a Departmental coal mine under the Railway Commissioners, placed an additional burden on the Railway Administration. No expense was spared in the col-

ration. No expense was spared in the



works, nearly only, in 1912, leased another portion to Lloyd's Copper Smelting Co. Ltd. (Later Monmouth Copper Mines Ltd) for re-claiming its Buranga area until 1919 or 1920. George Hoskins used the extended portion under Vale Street for the supply of material for his Presbyterian Memorial Church, dedicated in 1925, but this last-named section fell into disuse and was removed in 1949.

In 1926, Hoskins Iron & Steel Ltd., the then owner, disposed of the siding to the Council who, in turn, leased it to British Imperial Oil Co. (Later Shell Co.) for an oil depot. In 1940, Australian Motorists Petrol Co. Ltd. leased a short portion of the siding and removed it April Siding in May 1949.

Lithgow Municipal Councils had a siding for handling of coal constructed right into the works' yard in 1915. Owing to the position of the sidings, it was necessary to provide a short dead-end at the rear of the existing one behind the down platform at Eskbank, thence by a back slant across Brown's Siding and the adjacent Line into the Council's yard.

Lithgow Valley Colliery Siding was opened in 1873 as a branch on the down side of the line, 45 chains in length. Its junction points in the main line faced down trains and were situated where the western end of the siding platform came five years later.

The branch crosses Main Street on the level and the colliery yard is right in the town but has not been used since 1957. Coal was delivered from tunnel mouth to screens over three loop sidings and empties were pushed up into the dead-end for gravitation to the screens. The brick, pipe and pottery works, attached to the colliery, were situated on a hill overlooking the colliery and there was a steep incline with tail-rope haulage for railway vehicles from the colliery yard. The pottery closed down in 1946.

Hermitage Colliery Siding is on the up side of the main line and was opened in 1874 to serve Brown's Colliery, being renamed Lucas' Siding in 1887 and given its present name in 1890.

With a length of 50 chains, it left the main line, the points facing down trains, a few chains west of the Lithgow Valley Colliery point. It crosses the road leading into the Shoground on the level, just outside the boundary fence, and bearing North-east, bridges Farmer's Creek, to turn North-east and crossing Goodbrook Street on the level before reaching the colliery yard.

Coal is delivered by the mine haulage to the screens over three loop sidings, while empties are pushed up into one of two dead-ends, to be gravitated into the screen openings as required. The colliery is still operating.

Vacuum Siding was opened on the 20th February 1925, to serve that company's oil depot on the southern side of Main Street, which is crossed on the level. The siding is a dead-end and connects in a trailing direction with the down main line.

### The Railway Network of the Iron and Steel Industries

All sidings of this nature have been demolished and the Steelworks Colliery line was closed early in 1958. There was a considerable amount of sidings at one time and a number of privately-owned steam locomotives were employed. It is anticipated that this matter will be the subject of a special article shortly, so we will confine ourselves to those portions affecting the New South Wales Railways.

It will be necessary, however, to set out a brief summary of the various owners-ships involved. In 1874, James Bartholomew established the Eskbank Ironworks Company but the company languished and was only saved from extinction by its employees forming a co-operative concern to carry on the business.

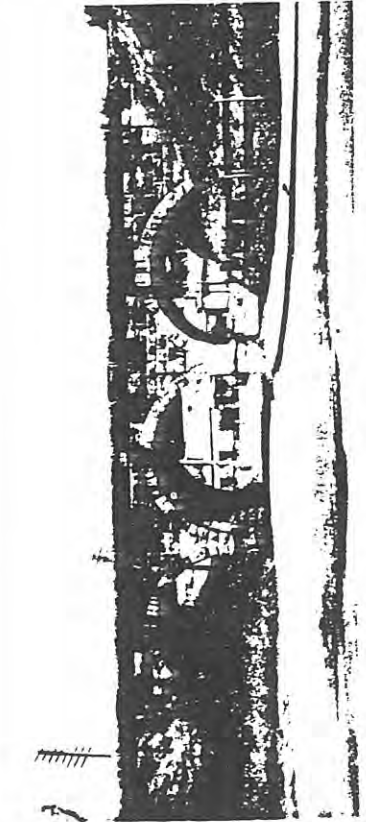
William Sandford obtained a seven-year lease in 1886 and finally purchased the works in 1904, the company, Wm. Sandford Ltd., being formed in 1901. After further financial difficulties, the firm sold out to the newly-formed G. & C. Hoskins Ltd. in 1908, which became Hoskins Iron & Steel Ltd. in 1919. After the death of Charles Hoskins in February 1926, the company was reformed again as Australian Iron & Steel Ltd. and the industry was transferred to Port Kembla.

The Ironworks Siding, connecting the railway with the Ironworks on the up side of the main line, was opened in 1878, the junction then facing down trains not far from Brown's Siding. It crossed Inch Street, Tank Street and Reid Avenue on the level before entering the works area on Farmer's Creek. Government engines placed trucks clear of Reid Avenue level crossing, from where they were hauled by horses to the works, owing to the sharp curves on this part of the line.

Between 1884 and 1890, a small steam locomotive, owned by the firm, replaced the horses, and this was followed by a steam locomotive crane, which shared the local shunting in the works yard with the horse until 1905, when a locomotive was permanently put to work and several more locomotives were added as the business expanded.

To supply coal for the works, Ironworks Tunnel Colliery was opened from 1875, as an adjunct to the Ironworks but was not given a separate title until 1881. The haulage tunnel emerged inside the Ironworks yard.

The vacant area between Tank Street and



One of John Whitton's beautiful stone arch viaducts, originally built to carry the line over a creek but now serving as an underbridge for Albert Street. (Photo: New South Wales Railways)

the ironworks was occupied in 1905-6 by the Great Cobar Syndicate, which used the iron-works siding for access to the railway and laid in sidings to its refining furnaces from points near Reid Avenue crossing, the Government locomotives carrying out the shunting. In 1900, a large electrolytic plant was provided for the separation of gold and silver.

The original firm, owned by the Longworth family, was taken over by Great Cobar Ltd. in 1900 but, after a life of 12 years, finally went out of production, as the industry moved to Port Kembla. The area was taken over by G. & C. Hoskins and the buildings and sidings were demolished in 1923 to make room for extensions of its iron and steel business.

Cobar Tunnel Colliery was opened in 1909 as part of the Great Cobar undertaking, the haulage emerging from the mine tunnel into the works area. In 1941, as the result of a fatality, caused by the derailment of a Government locomotive on the sharp curves in "Frog Hollow" (as the Hoskins' yard was known), Exchange Sidings were laid in on the old Cobar site, for the handling of trucks between Government and private engines.

Although steel was actually produced in the original area, it was always referred to as the "Ironworks."

Slattery & Williams' timber yard occupied the triangular piece of land at the corner of Inch and Tank Streets, through which the Ironworks Siding passed and the timber firm indulged in a certain amount of unofficial loading of trucks.

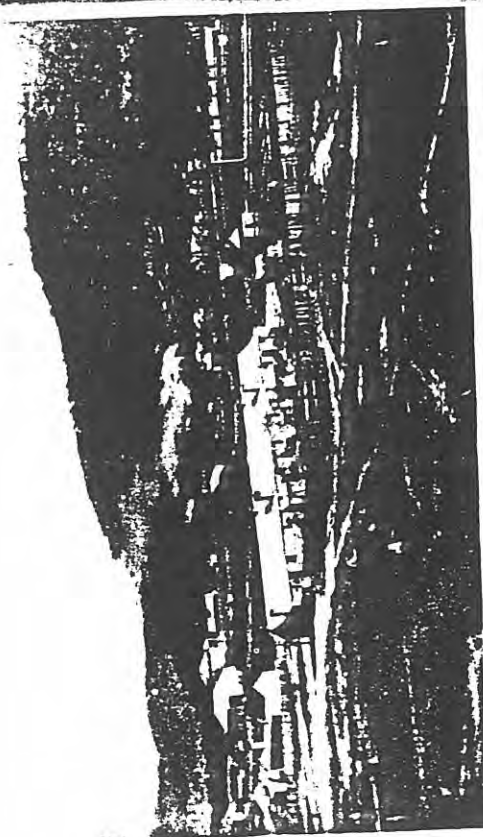
The Ironworks' area went out of produc-

tion in 1911, as part of the transfer of the Hoskins' interests to Port Kembla, and the plant and buildings were demolished in easy stages, so that it was not until February 1941 that the remnants of the sidings between New Ford and the Exchange Sidings were removed.

Blast Furnace Sidings. In 1900, William Sandford Ltd. commenced the erection of a blast furnace on a new site in the old shoground, opposite the Coal Stage. A siding was opened off the Dump Road of the Coal Stage in September 1906, to supply materials for this work. The firm's locomotive was placed there to work the sidings as the Government engines could not negotiate the sharp curves. In April 1907, the first blast furnace was blown in. G. & C. Hoskins took over the Sandford's interests in 1908 and in 1913, a second blast furnace was brought into use. All rail business at this period was conveyed through the only connection at Coal Stage.

As it was desirable to transfer hot ladles by rail between the blast furnaces and the Ironworks, the Railway Commissioner, naturally, would not permit such dangerous traffic over a public line, so it became necessary for the firm to construct its own independent railway between those points.

Commencing at a junction with the blast furnace sidings, immediately at the rear of and adjacent to the Coal Stage, the company's new line descended steeply to the back of the old loco yard to cross Inch Street by an underbridge, from where it curved to avoid "Eskbank House", the old residence of Lithgow's pioneer, Thomas Brown. The line pro-



Eskbank Station and goods yard, viewed from the East, about 1942. The smoke in the middle distance is coming from the old Eskbank Ironworks and, on the extreme left, the goods shed and the end of the station building can be seen.  
(Photo: New South Wales Railways)

ceded to the rear of the dog track and crossed Union Street and Tank Street on the level, before entering the ironworks' yard.

In 1928, the blast furnaces were closed down permanently and the plant and sidings removed, with the exception of the independent line and a couple of storage sidings.

Hoskins' Lake Open Sidings. As an adjunct to the blast furnaces near Coal Stage, coke ovens were built along the Northern boundary of New Yard for most of its length, the sidings being given a connection with the Departmental departure road, Coal Stage, and opened in 1913. Independent access for the company's engines was given by a connection from the Blast Furnace Sidings to the coke ovens, and a further connection was made between the Blast Furnace Sidings and 80.3 road, New Yard, to enable traffic to be exchanged without the private locomotives running the departure road. This meant that the Zig Zag Colliery branch was crossed on the level by both connections and these alterations were completed by the 21st May 1914.

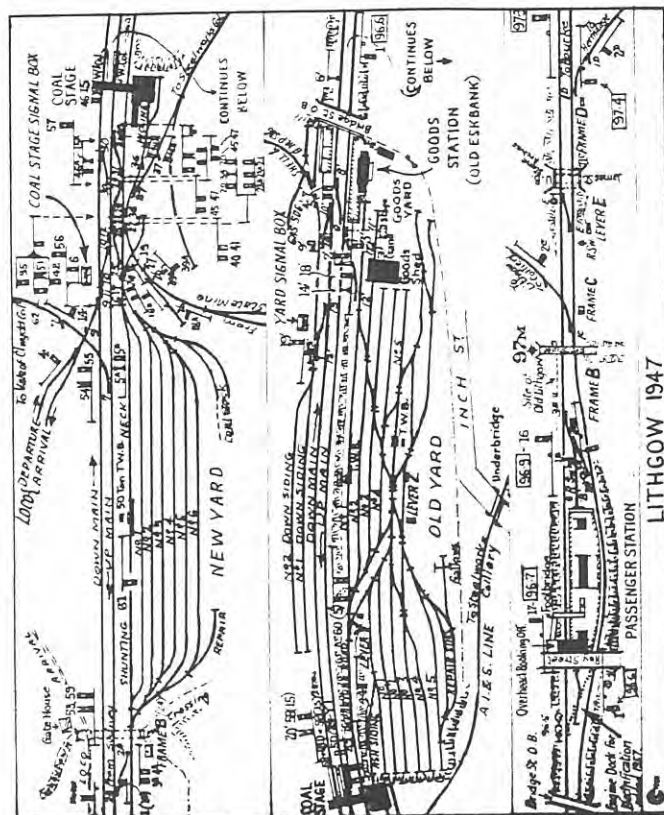
In 1920, the Departmental Coal Mine Line crossed the two private connections on the

level and, in 1914, frame "C" was provided to operate the catchpoints and protecting signals to avoid any risk of collision. This rather complicated arrangement is shown specially in the accompanying diagram. When the blast furnaces were closed down in 1928, the coke works were demolished and sidings removed.

Steelworks Colliery. In order to supplement the coal from Ironworks Tunnel, Hoskins opened up a new mine in Port's Gully opposite the State Mine. To assist in its construction, a line was hurriedly built in 1922 from the Ironworks yard, over under-bridges thrown across Tank and Union Streets rising steeply on a high level viaduct over Farmers Creek and Baccala Street, continuing up the side of Port's Gully at 1 in 40 to 47, to cross Mount Street on the level before reaching the colliery yard.

The shaft delivered coal to screens over three loop sidings, empties being pushed via the arrival road to the dead-end for gravitation to the loading position.

In 1926, the line was relaid and brought up to a better standard in anticipation of the first coal, which was won in June 1927.



The move to Port Kembla, that closely followed, caused an alteration to be made in the operation of this line, as A.I. to S. wished to remove all its engines to Port Kembla and not have to retain one for its sole mine railway.

In order that Government locomotives could work the branch, a new line was taken from the Southern end of the Farmers' Creek viaduct to join the blast furnace line at the rear of the dog track and thus to connect with the Government system at Coal Stage. This line had a grade of 1 in 38 against the load from Inch Street up to the Blast Furnace Hill but, in the empty direction, there were grades of 1 in 35 up to Farmers Creek viaduct and a short 1 in 22 up to the old blast furnace connection. The line was closed by Government engines until the viaduct closed down in 1958 and the fate of the railway is uncertain.

#### Lower Alterations

The limited size of Eskbank Old Yard was strained beyond its capacity by the nearness of the Zig Zag hot flue, aggravated by the growth of traffic from points west, in the early days of the century, while the longer

trains, then coming into operation, could not be made up in the short sidings available and tested for air clear of local shunting. The construction of the blast furnace by Sandfor 1, in December, 1906, gave a promise of more traffic to come.

As any extension of the old site was impracticable, owing to its position, four full-length goods loop sidings, known as New Yard, were laid in off an extension of the coaling road under the coal stage, which became the departure road, using timber openings alongside the 10' stone arch carrying the main lines. The Zig Zag Colliery branch was disconnected from the junction with the down main on the 1st May 1906 and reconnected with the new departure road as part of this work.

At the outlet end of New Yard at the conveyer level crossing, a new Oakley Park signal-box was opened on the 11th December 1907 and the shunting neck continued as a new Oakley Park branch, the old junction and signal-box being closed at the same time.

As the new blast furnace sidings were used with the coming into production of the blast furnaces, the connections in the viaduct



city of Coal Stage were remodelled and, on the 14th May 1906, the second Coal Stage signal-box replaced the old dinky structure, at a site on the Bourke side of the stage but still on top of the cutting.

Hoekins' coke ovens connections, including the two cross connecting lines for the private trains, were opened in 1913 and the State Nine branch came into the network in 1920. The yard in the vicinity of Coal Stage was remodelled and the Vale of Clwydd branch junction were included in the operations of still a third Coal Stage signal-box, opened on the Sydney side of the stone arch on the 7th April 1921. The new site was selected in anticipation of the new connections to the new locomotive depot on the down side of the line at Cornetown, which was completed in 1924.

On the 19th July 1924, automatic signal-line, with upper quadrant three-position arms, was brought into use between Eskbank signal-box and Rosebush and track block opened between Coal Stage and Eskbank boxes. All Lithgow Station ceased to be a block post and have control of signals or points and the two colliery junctions and the main crossover were put under the control of switch key track release.

The new island platform for the central station at Lithgow (90m, 04c.) was brought into use and the name "Eskbank" vanished. The new main crossover and carriage dead-end at the Bourke end of the platform were given switch key track release, the points of the Vacuum Sliding nearer Rosebush being still early controlled, when opened on the 20th February 1925.

On the 23rd June 1941, a pair of timber platforms, named Gowerhill (97m, 49c.), were brought into use at the Showground, between Lithgow and Rosebush, to cater for the large number of wartime employees of the nearby

Small Arms Factory. Many of the workers had their residences on the higher mountain stations and a daily train was run to and from Katoomba for them. This train still runs and reverses at Rosebush.

#### Road Crossings

The first road crossing after leaving Clarence is at Cornetown (95m, 10c.), opposite the modern locomotive depot and a female gatekeeper is still in charge. The small timber building for her accommodation indicates the crossing was not there at the time of the opening to Rosebush.

The stone arch overbridge at Bridge Street, at the Bourke end of Lithgow Goods Station, appears to have been there at the opening of the line, as it would carry the Bell Road (so called), which definitely served T. Brown's "Eskbank House" and was diverted to ultimately form Main Street, as shown on the working plan. This overbridge, with new precast concrete deck for the electrification, is at 90m, 44c.

There was a high-level overbridge at Bank Street, constructed with the growth of the town, which was later widened and reconstructed as a concrete arch at the new station entrance, the mileage given being 90m, 56c.

At 97m, 4<sup>th</sup> timber overbridge was provided over the creek, is now used as an opening for the diverted Albert Street, which was previously served with a level crossing at 97m, 20c.

There is a level crossing at 90m, 19c., on the Sydney side of Rosebush Station, which is supervised by the station staff.

#### THE DARRA ACCIDENT (by S. Pelford)

##### Queensland Railways

In 1924, train working on the Southern and Western Railway in Queensland was controlled by 10 Rules, Nos. 317 to 326. Rule 317 provided that "a train staff or ticket shall be carried by each engine or train without which no engine or train shall start unless by instructions from the Traffic Manager or Commissioner". Rules 319, 320, 321, 322 and 323 provided for the normal method of issuing tickets and with lock-up boxes.

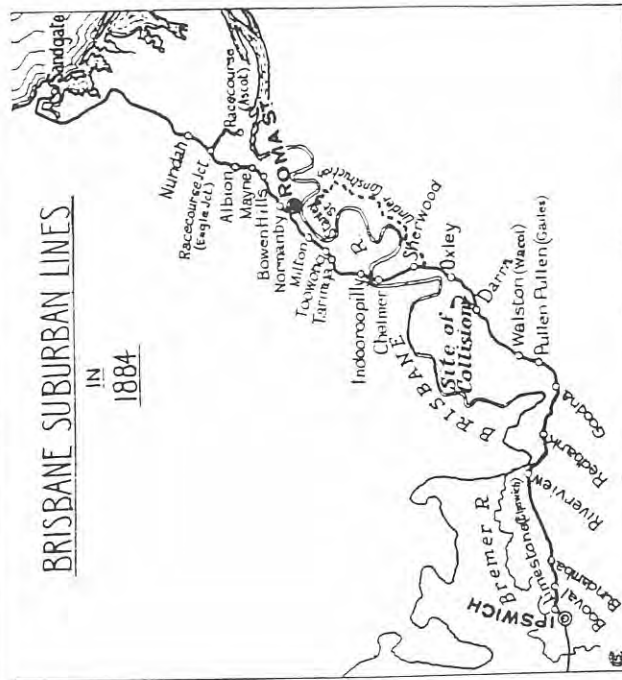
Rule 324, however, was curious - "Station-masters are alone authorised to receive and deliver the train staff or ticket into the hands of guards. Guards shall receive and

Station-masters to guards, who were to give them to the drivers; this, of course, required a stop.

To circumvent this rule, the simple expedient was adopted of suspending staff working altogether for these non-stopping trains. It was also said that traffic was so heavy on the Ipswich - Brisbane section that the regular staff stations were too few to cross trains. To get around this trouble the staff working was suspended for certain trains, so that a train carrying a soldier (now Wacol) to Goodna staff could cross a train without a staff at a loop in the section - at Pullen Pullen Flats.

Another way in which the staff system was abused was the working of suburban trains on Sundays. To cheapen operation costs, Station-masters were not brought on duty and passenger tickets were issued by clerks on the trains. Signals and staff-working were entirely suspended, with the Station-masters not being on duty, and the Stations American system of the timetable becoming the authority for trains to proceed as the method of working on Sundays.

This resulted in an accident on the 15th April 1954, when No. 2 (4.50 a.m. ex-Sundgate) and No. 5 (9.20 a.m. from Brisbane -



now Roma Street - to Rosebush - now Ascot) collided on a bridge between Bowen Hills and Bowen Hills Stations on the present Exhibition Loop. This Bowen Hills Station is not the station on the present Central to Bayne line but was probably near the present Exhibition Station.

No. 2, according to the timetable, should have reached at Bayne until No. 5 arrived. On its outward journey as No. 1, No. 2 had nearly had an accident at "the Allion", due to a timetable misunderstanding.

It was decided after the collision, that the no-signal or train staff system on Sundays be discontinued. A decision by Mr. A.O. Herbert, then Commissioner, that authorities of special trains by train notices be discontinued seems to have been misunderstood by Mr. Mackean, the Traffic Manager, who followed to introduce a continuous brake, it being considered that the continuous could have been avoided by better braking.

Mackean continued running special trains on train notices without staff, including passenger and Ministerial specials. On the 8th September 1954, he introduced "a special material train" to run each week (i.e. a regular train), which was to leave Brisbane at 4.30 a.m. on Mondays, stop overnight at



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that have become standard reference texts,

"An Historical Geography of NSW to 1901"

"Australian Pioneer Technology"

"The Open Air Museum"

"Industrial Archaeology in Australia"

"Australia a Geography, Environment"

"Australia a Geography, Space and Society"

For the Heritage Council of NSW he was co-author with  
Professor Ian JACK of a major regional history of NSW.

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Acknowledgment is made of permission to reproduce illustrations: to the Australian National Library the illustrations on pages 135 and 183; to the Trustees of the Dixon Gallery for the illustration on page 116; to the Mitchell Library for the illustrations on pages 16, 30, 226 and 239; and to the Government Printer, Sydney, for permission to reproduce the illustrations on pages 46, 54, 66, 70, 96, 176, 202, 156, 250 and 296.

possible, and accepting steep gradients and sharp curves to minimise earthmoving costs and distances. The American tradition appealed to those who saw New South Wales as having problems similar to those of the United States, particularly in regard to great distances, costly labour, scarce capital and the sparse settlement pattern which generated little immediate traffic for each mile of track built. But British fies were too strong for the American alternative to prevail: British engineers were appointed who argued that high initial expenditure would be offset by low maintenance costs without any need to replace the lines as traffic increased. Against them, Governor Sir William Denison led those who wanted low-cost lines, even advocating horse-drawn rather than steam locomotives. The debate over cheap railways recurred throughout the century at times of financial stringency.

Debate over construction standards extended to gauges. Despite the British government's recommendation of a standard gauge line of 4 ft 8½ inch, the first company engineer adopted the broad 5 ft 3 inch gauge of the Irish lines. The company building Victoria's first line followed suit; it held to the original decision when a new engineer in New South Wales reverted to the standard gauge. Though a third successive Chief Engineer in New South Wales tried to persuade his government to take up the broad gauge once more, he failed. By that time, 1857, only a few miles of line had been built, but the government chose to follow a different gauge from that of Victoria rather than re-lay the track. Queensland adopted a narrow 3 ft 6 inch gauge, and not until 1930 was there a standard gauge route from Sydney to Brisbane.

At first the inland lines were extended one stretch at a time, with the general intention to reach Goulburn and, if possible, Bathurst, the points where inland roads converged before crossing the Great Dividing Range to reach Sydney. The southern line reached Picton in 1863, and with horse-traction once more advocated and rejected, it was extended to Goulburn in 1869 following a route which included steeper gradients (up to 1:30) and sharper curves than those of the British railways. The rugged country was not so easily crossed to the west, and routes were sought both from Richmond and Penrith before the solution was found to be two costly zigzags which allowed trains to ascend the Blue Mountains plateau and then descend into the Lithgow Valley. Tunneling was rejected as too expensive, and inclined planes worked by stationary engines had proved disastrous in North America. This line was then extended west to the Macquarie River at Kelso by 1875.

Meanwhile the northern line passed through Maitland to reach Singleton in 1863. It bypassed Morpeth, which was linked to it by a branch line; but this link did little for the port, because as the main line moved north it gathered traffic which preferred to flow past Morpeth to the improved harbour at Newcastle. At this time Newcastle was also handling growing tonnages of coal brought from the neighbouring coalfield by both government railways and private colliery lines. From Singleton the main line turned northwards, ignoring the Cassilis Gate which provides the easiest crossing of the Divide in New South Wales. The western country's traffic was led to Sydney by way of Bathurst rather than to Newcastle. In 1872 the line reached Murrumbidgee, bringing to this town a boom period as railroad and construction camp for the crossing of the Liverpool Range near the old road route. Tamworth, on the threshold of New England, was reached in

1878 and thus given a rail connection with Newcastle, though as yet there was no line through to Sydney.

By the early 1870s only a limited mileage had been built, but it was enough to shorten dramatically the trip from Sydney to parts of the interior particularly the crossing of the Blue Mountains between Sydney and Bathurst, a bad road with little feed or water for the bullocks, which had taken up to thirty days for the journey in 1857 according to Sir William Denison, though 10 days was more usual. The greatly expanded and costly building programme which began in the mid-1870s was in part justified by the advantages of railways over roads, and the way in which railway-building reduced Treasury expenditure on roads. The Commissioner for Roads, in 1869, had allocated sums of fifty pounds per mile of main roads outside districts served by railways, but none at all for districts within reach of the lines. Only gradually did roads come to be seen as complementary to railways, but by the end of the century blue-metalled main roads were spreading inland; as they did so, horse teams replaced the bullocks, whose vulnerable hooves needed the old dusty tracks. Even in the 1890s, horse teams managed to compete with the railways, particularly when operated as a sideline by farmers.

The new vigour in building coincided with concern at the loss to Melbourne of much of the trade of southern and western New South Wales. To forestall this poaching, new lines were to be built into the Riverina, to Albury and the towns of the lower Murrumbidgee. In 1881 the southern line reached Albury by way of Wagga, and in the following year the Murray was bridged to link this new line with the Victorian railroad that had reached Wodonga in 1873. With this line Victoria had drawn off trade from the eastern Riverina, while in the west it had first built to the border at Echuca in 1864, and then, with the aid of a private company, reached Deniliquin along a broad-gauge line in 1876.

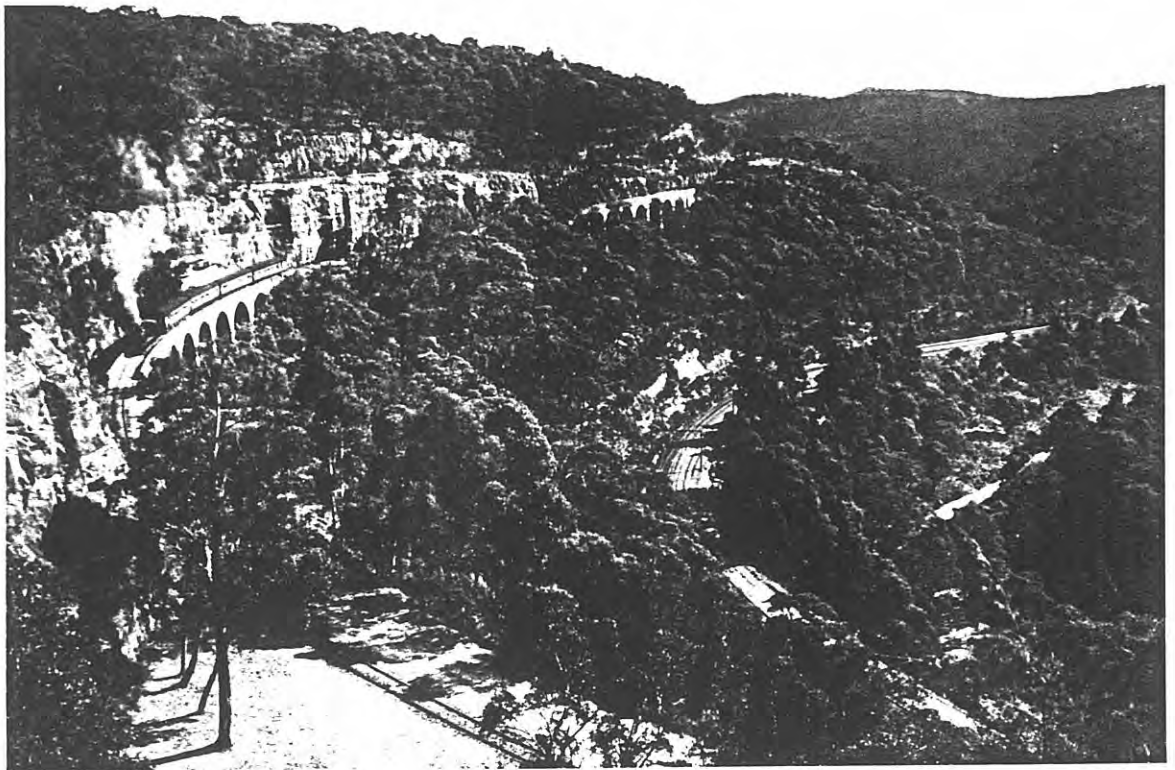
Building in the west of New South Wales was less urgent; the western line was extended to Orange to exploit the traffic of that developed mining and agricultural district before a decision was taken on the final western destination. A western line might have tapped the Darling River trade at Wilcannia by way of the Lachlan, or at Bourke by way of Wellington and Dubbo; more certain commercial success lay at Bourke which was the river trading centre most remote from South Australian ports, so this destination was chosen in 1877.

From Tamworth too there were a number of alternatives: a line might have been built northwards along the New England Plateau through Armidale to the Queensland border, or it might have extended only to Armidale, while another line from Tamworth might run northward on the western margin of the Plateau to Inverell and on to Tentfield and the border, leaving the Glen Innes district to be served by a line from Grafton. Though the latter, more complex plan appealed to the majority of local interests, notably those of the port town of Grafton, the least-distance solution of a single line following the narrow divide was chosen.

While the trunk routes were being surveyed, some minor lines were planned and built in the early 1880s. Goulburn was linked with Cooma on the southern tableland, and two agricultural districts around Tumut and Mudgee were given branch lines. An important link was made between the Southern and western lines at Murrumbidgee



## INTERNATIONAL RATING

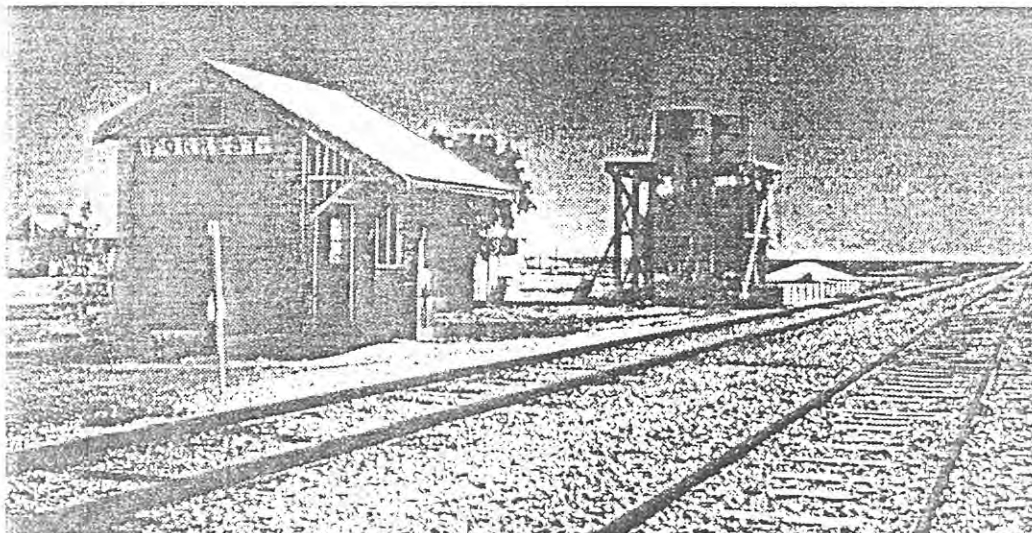


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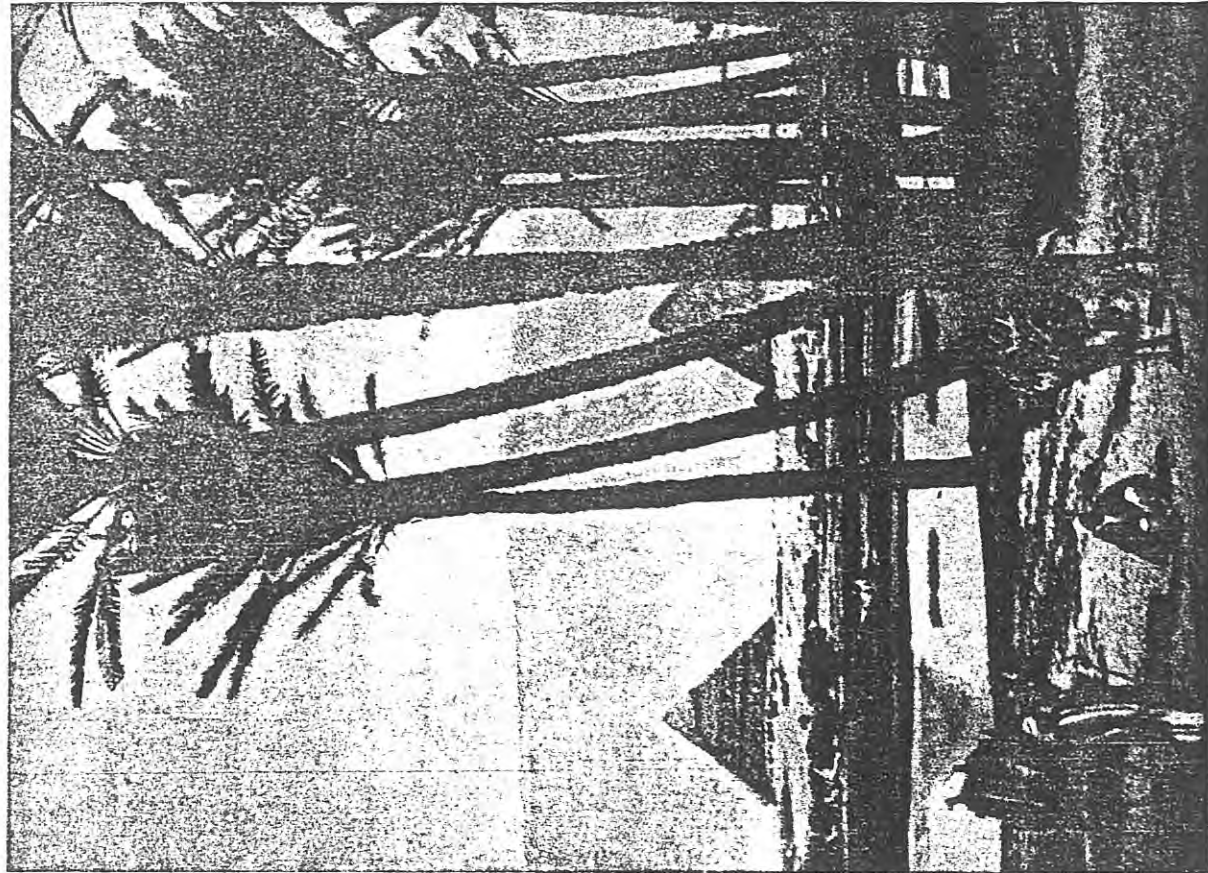


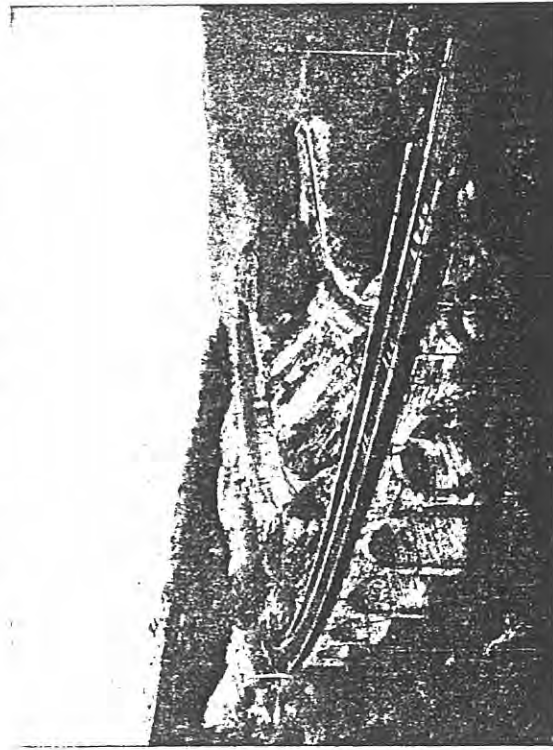
Photo by Underwood & Co. Ltd.

ARABS, PALMS, AND PYRAMIDS.





seventy miles at its southern extremity, leaves between itself and the mainland a channel which remains unruffled even by the fiercest storms that blow. The reef, which is pierced by several openings, is one of the favourite haunts of the curious cucumber-shaped trepang, or sea-slug, so highly esteemed by the Chinese as a toothsome delicacy.



*Photo. by Kerry & Co., Sydney.*

**Zigzag Railway up the Blue Mountains.**

4. When we turn to the surface of the great island-continent, we find that the most elevated region occurs along the east coast. Here is the Dividing Range, extending as a long chain, under different names and with a constantly decreasing elevation, from Wilson Promontory in the south to Cape York in the north. Even the Australian

Alps of the south-east corner, suggestive though the name is of towering heights, mighty glaciers, rushing avalanches, and deep blue lakes, rise little higher than 7000 feet, and are clothed almost to their summits with dark-green forests instead of with glittering ice-fields. The highest point of the range is found in Mount Kosciusko.

5. On its outer edge the Dividing Range sinks very abruptly, forming a bold, picturesque background to the fertile east-plain which skirts its base. On its inner edge it descends gradually to wide-spreading, billowy plains, on which millions of sheep and cattle are reared. Farther inland these pass into the salt-bush plains and sandy deserts of the almost rainless interior. The western half of the continent is occupied by a vast tableland of low elevation, fringed by a chain of highlands along the shores of the Indian Ocean.

6. Owing mainly to the want of water, a large part of the interior long remained a land unknown. But in spite of almost overwhelming difficulties, intrepid explorers like Sturt and Stuart, Burke and Wills, Eyre and Forrest, pushed their way through trackless deserts, and brought to light the secrets of the hidden interior. It has been made abundantly clear that the central and north-western regions are largely a stern, forbidding wilderness, clothed, where clothed at all, only with thorny shrubs and the terrible spinifex or porcupine-grass, whose leaves have been likened to 'knitting-needles radiating from a huge pin-cushion.' We must look nearer the coasts, especially those of the eastern half of the continent and the extreme south-west,



RAILWAYS OF THE WORLD

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2      *Railways of  
Australia*

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O. S. NOCK

B.SC., C.ENG., F.I.C.E., F.I.MECH.E.

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country, with a ruling gradient of 1 in 75, constant and severe curvature and station altitudes varying between the 3336 ft. of Katoomba and the 3501 ft. of Bell. Actually the highest point on the line is reached about  $1\frac{1}{2}$  miles west of Bell, at 3584 ft. Despite the easier gradients this is not a stretch for fast running, and because of the curves the maximum attained is around 45 m.p.h. A continuous descent begins at milepost 86 $\frac{1}{2}$  from Sydney, though at Clarence, 89 miles, the altitude is still 3468 ft. Then the line comes to the western escarpment, with an abrupt natural fall to the town of Lithgow; and here John Whitton was faced with an even more formidable task than on the Lapstone cliff face. He surmounted this great task with a piece of engineering that in its day was as famous as the spiral tunnels of the Alps, or the Victoria Falls Bridge in Rhodesia; the great Lithgow Zig-Zag.

Gliding down the gradient today over the 'new line', even though riding in the cab, it is difficult to appreciate the nature of John Whitton's task. Just after the highest point on the line a descent on the very moderate gradient of 1 in 90 begins, and through an increasingly rocky defile, with far more straight track than we have experienced so far on this line, we cut through a succession of no fewer than ten tunnels. Most of them are quite short, but all had to be blasted through solid rock and with the limited local experience at the time the original line was built, tunnels were things to be avoided if possible. Leaving the last tunnel and emerging into a densely-wooded glen, above which rise great beetling cliffs on either side, we pass Zig-Zag signal box, and with no more than a glimpse at this stage of graceful viaducts high up among the trees a precipitous descent of 1 in 42 is entered upon. Speed is now held to no more than 22 m.p.h. and so we come to the outskirts of Lithgow. There is a large, and one-time well-equipped yard for steam locomotives, where a few of the celebrated 2-8-0 engines of Class '50' may still be seen today, and then we enter the island platformed station of Lithgow, just 97 miles from Sydney. The journey has taken 2 hr. 36 min. inclusive of six intermediate stops. Lithgow is the limit of electric traction on the west main line; thenceforward the haulage is diesel or steam.

From Lithgow we retraced our steps to Katoomba by road, and this proved an unrivalled way of seeing the Great Zig-Zag. We first of all made our way to the present Zig-Zag signal box on the electrified line. This is now opened only on special occasions because the line is com-

pletely equipped with automatic colour light signals, and no train has occasion to stop at 'Zig-Zag' unless closely following another one, and receiving a momentary check. The problems of working have been greatly simplified since electrification. In steam days many heavy east-bound freight trains had four locomotives from Lithgow up the 1 in 42 gradient to Zig-Zag box. Such trains were triple-headed, with the fourth locomotive banking in rear. At Zig-Zag box a stop was made for the leading engine and the banker to be detached. Then the train continued up the 1 in 90 ascent through the ten tunnels with two engines at its head. 'Zig-Zag' is typical of the smaller signal boxes on the line, of an all-timber design strongly reminiscent of the Lancashire and Yorkshire Railway. In 1911 C. B. Byles, the Signal Engineer of the latter railway, was invited to go to New South Wales as signalling adviser to the Chief Commissioner of Railways in that State, and he was subsequently appointed Signal Engineer. A connoisseur of mechanical signalling equipment can detect many features that would at one time have been familiar on the L. & Y. R. at home.

From an inspection of Zig-Zag signal box we took to the road once again, and then proceeded to climb the face of the great escarpment on a road made over the route of the original railway zig-zag. It was an absolutely fascinating experience. We drove slowly over the viaducts, looking down to the double-track main line of today, passing through a short tunnel, and stopping to inspect the present roadway at the site of one of the reversing places. The great Zig-Zag was entirely single-tracked, but the viaducts are wide enough to permit cars to pass abreast. Today the slopes are densely wooded, and even from vantage points of the viaducts it is not easy to discern the alignment of the original railway; but when first constructed the slopes were quite bare, and the complete extent of the zig-zag seen from either side presented a truly magnificent spectacle. Driving slowly over the track today I was very conscious of being in the presence of railway history of the very first importance. Although there was a minimum of tunnelling some tremendous blasting operations were necessary. Two masses of rock in particular, one estimated to weigh 40,000 tons, and another 45,000, had to be dislodged. The events were publicised well in advance and large numbers of spectators came to Lithgow to see the 'blasts'. The second blast was of such importance that the Countess of Belmore, wife of the Governor-General,



# Contemporary Authors

A Bio-Bibliographical Guide to  
Current Writers in Fiction, General Nonfiction,  
Poetry, Journalism, Drama, Motion Pictures,  
Television, and Other Fields

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## PLAYS

- "Like Father, Like Fun" (three-act), first produced in Vancouver, B.C., at Playhouse Theatre, 1966, produced as "A Minor Adjustment" on Broadway at Brooks Atkinson Theatre, October 6, 1967.
- "Beware the Quichly Who" (two-act children's play) first produced in Vancouver at Metro Theatre (now Holiday Theatre), 1967.
- "The Clam Who Made a Face" (one-act children's play) first produced in Vancouver at Holiday Theatre, 1968.
- "The Fourth Monkey" (three-act), first produced in Vancouver at Playhouse Theatre, 1969.
- "Pillar of Sand" (two-act), first produced in Ottawa, Ont., at National Theatre, 1973.
- "Free at Last" (one-act), first produced in Vancouver at New Play Centre, 1979.
- Also author of three-act play, "Regulus," first produced in Vancouver at Peretz Theatre. Also author of television plays "The Bathroom," 1963, and "The Man from Inner Space," 1974; author of several dozen radio plays.

## OTHER

- Contributor to radio revue, "Inside from the Outside" (CBS), 1970. Contributor to *Maclean's* and *Saturday Night*.
- WORK IN PROGRESS: A stage play.
- AVOCATIONAL INTERESTS: Tennis, badminton, gardening.

\* \* \*

## NIVEN, Alastair 1944-

PERSONAL: Born February 25, 1944, in Edinburgh, Scotland; son of Harold Robertson (a civil servant) and Elizabeth (Maar) Niven, married Helen Trow (a university administrator). August 22, 1970, children: one daughter. Education: Gonville and Caius College, Cambridge, B.A., 1966, M.A., 1969. University of Ghana, M.A., 1966, University of Leeds, Ph.D., 1972.

ADDRESSES: Home—Eden House, 28 Weathercock Lane, Woburn Sands, Buckinghamshire MK17 8NT, England.

CAREER: University of Ghana, Legon, lecturer in English, 1968-69; University of Leeds, Leeds, England, lecturer in English, 1969-70; University of Stirling, Stirling, Scotland, lecturer in English studies, 1970-78; Africa Centre, London, England, director-general, 1978-84; University of London, Institute of Commonwealth Studies, London, Henry Charles Chapman Visiting Fellow, 1984-85; writer, honorary lecturer, School of Oriental and African Studies, University of London, 1979-85. Chairman of welfare policy committee, United Kingdom Council for Overseas Students Affairs, 1981.

MEMBER: Royal Commonwealth Society, Association for Commonwealth Literature and Language Studies (member of executive committee, 1975-80), Greater London Arts Association (chairman of literature panel, 1981-84).

AWARDS, HONORS: Commonwealth fellow at University of Ghana, 1966-68.

## WRITINGS:

(Editor) *The Commonwealth Writer Overseas*, Dublin, 1976.

*J. H. Lawrence: The Novels*, Cambridge University Press, 1978.

*The Fake of Pity: The Fiction of Mark Raj Anand*, Arnold Heinemann (India), 1978, published as *Yoke of Pity: Study of the Fictional Writings of Mark Raj Anand*, 1981.

*Truth into Fiction: Raja Rao's "The Serpent and the Rope"*, Writers' Workshop (Calcutta), 1978.

(Editor) *Notes on Gulliver's "Land of the Flies"*, York Notes, 1980.

D. H. Lawrence: *The Writer and His Work*, Scribner, 1980.

*Elechi Amadi's "Concurrence"*, Collings, 1981.

## CONTRIBUTOR

Anna Rutherford, editor, *Common Wealth*, Akademisk Boghandel (Aarhus, Denmark), 1971.

William Walsh, editor, *Readings in Commonwealth Literature*, Oxford University Press, 1973.

Damien Grant, editor, *D. H. Lawrence*, British Council in Japan, 1977.

Walsh, editor, *Commonwealth Literature*, Macmillan, 1979.

Daniel Massa, editor, *Individual and Community in Commonwealth Literature*, University of Malta Press, 1979.

Also contributor to *Awakened Conscience*, edited by C. D. Narasimhaiah, Sterling (New Delhi).

## OTHER

Contributor to periodicals. Member of editorial advisory board of *Ariel*, *Kuwait*, and *Wadafiri*; co-editor of *Journal of Commonwealth Literature*, 1979.

WORK IN PROGRESS: A history of Commonwealth literature.

SIDEGLIGHTS: Alastair Niven writes: "Literature is an international means of communication. My main interest is seeing that people of different cultures talk to each other."

AVOCATIONAL INTERESTS: Travel (Africa, Europe, India).

\* \* \*

## NOCK, Oswald St(evens) 1905-

PERSONAL: Born January 21, 1905, in Sutton, Goldfield, England; son of Samuel James (a bank manager) and Rose (a teacher; maiden name, Stevens) Nock; married Olivia Hattie Ravenall, May 15, 1937; children: Jill Stevens Nott-Bower, Trevor Stevens. Education: Imperial College of Science and Technology, London, A.C.G.I., 1924, B.Sc., 1924, D.I.C., 1925, F.C.G.I., 1984. Politics: Conservative. Religion: Church of England.

ADDRESSES: Home—28 High Bannetdown, Bath BA1 7JY, England.

CAREER: Westinghouse Brake & Signal Co. Ltd., London, England, 1925-68, trainee, 1925-37, worked in various departments, 1926-35, draftsman, 1935-37, senior design draftsman, 1937-45, mechanical engineer, 1945-49, chief draftsman in brake department, 1949-57, chief mechanical engineer, 1959-65, planning manager, 1965-68, writer, 1968—.

MEMBER: Institution of Civil Engineers (fellow), Institution of Mechanical Engineers (fellow), Institution of Railway Signal Engineers (honorary fellow; past president).

## WRITINGS:

*The Locomotives of Sir Nigel Gresley*, Longmans, Green, 1945.

*Locomotives of the L.N.E.R.: Standardisation and Renumbering*, 2nd edition, London & North Eastern Railway, 1947.

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difficulties hampered construction for five years and, in the event, the government acquired the undertaking on September 3, 1855, 23 days before the official first train ran over the 13½-mile 4ft 8½-in-gauge line. Thus, the first NSW railway became the first state-owned steam railway in the British Empire. In practice, the constructing contractor, a Mr William Randle, operated the line under licence from a newly appointed board of commissioners for the first 12 months. Service was started with four 0-4-2 locomotives supplied by Robert Stephenson, and 32 carriages and 57 goods wagons, all from England.

As the oldest of the railway constructing bodies in Australia, the Sydney Railway Company accepted the advice of its Irish engineer, a Mr Shields, to adopt the Irish 'standard' gauge of 5ft 3in. for its Sydney-Parramatta line. The Victorian and South Australian governments agreed to the proposal and rolling stock for the Melbourne-Sandridge and Goolwa-Port Elliott lines was ordered accordingly. Shields resigned; a Scot—James Wallace—was appointed to replace him and persuaded the Sydney Railway to adopt 4ft 8½in for its track. As no rolling stock had been ordered, the directors agreed, and from that small beginning, Australia's rail gauge muddle began.

After its acquisition of the Sydney Railway Company, the NSW government assumed responsibility for most railway construction in that state, where early builders faced tremendous problems. The city of Sydney is surrounded by rocky plateaux and mountain ranges, the ascent of which required great engineering skill. Chiefly responsible for overcoming those problems was Mr John Whitton, appointed engineer-in-chief in 1857. He fought and won a battle to build full-scale railways instead of narrow-gauge horse-worked tramways and even today, many of his engineering works are in constant use. He was responsible for the design and construction of 2,100 miles of railway

during his 33 years of office.

Jointly with development out of Sydney, the NSW government provided rail connections inland from Newcastle, 100 miles to the north and a port on the Hunter river. The first 20-mile section of what became known as the Great Northern Railway opened in 1857; it was gradually extended towards the Queensland border, which was reached at Wallangarra in 1888. The Queensland Railways had built their line south from Brisbane to Wallangarra in 1887.

Meanwhile, progress out of Sydney was slow. The escarpment of the Blue Mountains presented a barrier to the settlement of the rich Bathurst/Orange area which was finally broken when Whitton designed two zig-zags for carrying the line over the range. The more spectacular, the Great Zig-zag near Lithgow, achieved world fame when it came into use in 1869; its three graceful sweeps carried the line down into the valley on a grade of 1 in 42. Increasing traffic forced major expenditure on tunnelling and re-grading to eliminate the zig-zag in 1910, but its stonework is preserved today as a national monument.

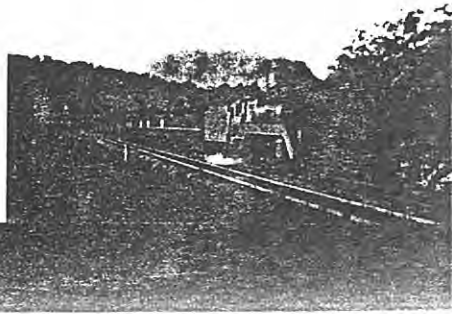
Because the route to be followed was somewhat easier, progress on the main line south from Sydney proceeded quite rapidly. Long stretches of 1 in 40 gradient were, however, common on the route through Goulburn (reached 1869), and Wagga Wagga (1879) to Albury (1881). There the matter rested until 1883, when the two state governments had decided on how the bridge across the Murray river was to be financed, and inter-colonial communication was established.

The years 1880-1885 saw great progress in the railway network, with 1,000 miles of new lines constructed. But Sydney and Newcastle remained unconnected by rail, although the gap had been narrowed to a four-mile ferry journey along the Hawkesbury river. At last, in May 1889, a 2,900ft rail bridge over that river was opened,

linking Sydney and Newcastle, and making possible a through rail journey from Adelaide to Melbourne, Sydney and Brisbane—albeit with two gauge changes en route. NSW resisted the temptation to cheapen rail construction costs by changing to a narrower gauge for feeder lines. Instead, they remained standard-gauge 'light' lines, built as cheaply as possible for a designed speed of 15mph, to be improved when funds permitted.

Long distances are a feature of travel in NSW, and at an early stage night-time mail passenger trains became an established pattern of service. In consequence, sleeping cars were introduced quite early, in 1877, and eventually formed a large fleet for the inter-colonial expresses and other night trains. Only in the years since the 1939-45 war have higher-speed day trains tended to supplant night trains on premier passenger services. The NSWGR system has for many years been the busiest of all seven in Australia. Route mileage at peak was only slightly below that of Queensland, but the density of traffic warranted construction of double track over many hundreds of miles and, in later years, electrification to handle rapidly growing tonnages.

As with most other Australian railways, the NSWGR relied mainly on English sources for early locomotives, but by the 1870s, local builders were at work, including the railways' own workshops. Clyde Engineering later became a prominent supplier and the American Baldwin company a continuing supplier. Continuing capacity for hard work, longevity, and success have characterised a number of



THE GREAT ZIG ZAG  
THE SLEEPING GIANT



a total strength of side. The issue in St. Leonard's, e. is only a question of the Liberals forward and indicating their prin- y recording their vote. Public men e fought in previous battles are now round the flag of Liberalism in this ar electorate. Amongst these, At- John Carter, Mr. McIntosh, Mr. Cres- d Alderman Watmore are prominent

hand Democracy.—The Archbishop of (the Right Rev. Dr. Donaldson), g in St. Andrew's Cathedral yester- a service for men, when his Excel- rd Chelmsford was present, said they ing continually reminded that the was out of touch with a great por- the men of this democratic Common- It had been forcibly put during week that the people were divided great sections, and that the Church in touch with those in one section. were so, it was a solemn and seri- ight. They were all conscious that tain extent the Church was out of th young democracy, and he could not ling it when he saw the thousands men who were walking the streets ne past evenings. The Church had been told they should study so- tions more, that they should show npathy with the great mass of de- that the clergy should preach more l subjects. But, however true that the real remedy lay deeper. The s a society of men pledged to live ristian lives, bound together by a brotherhood, but working in all society. These men could talk to rther, and show by the examples of n lives that Christianity was a re- men. Paul's writings alone, though e powerful and inspiring, could not erted the world—it was the people them who became the mighty force.

In the Streets.—A short time ago y aldermen decided unanimously to n offer of six carved statues from yor (Alderman James Bonner), and m in the main thoroughfare and the reserve. Protests were made by dents at the funeral appearance of e, due to the erection of the statues, ition was taken round, signed by ns, and forwarded to the municipal s. Nothing more was heard of it the last meeting, a communication lved demanding the reason for the ntation of the petition to the coun- It was quite evident that the knew what had become of it, be- nedately the letter was read sever- s the petition had been considered ra" or committee, and, desiring to the full strength of the protests, nell held the matter over, Inquiries as to the bona the signatures. The results rided as "startling." Over 50 per the persons signing the petition, to the Town Hall officials, were not micipal roll, and one person signed ent, it was alleged, several times. e discussion the Mayor remained d it was apparent his brother al- cognising the generosity of his gift.

## PASSING OF THE ZIG-ZAG.

### THE NEW DEVIATION.

(BY OUR SPECIAL REPORTER.)

With the commencement of the summer time, the famous Zig-Zag, which has for over 10 years been the most interesting feature of the railway journey westward, was relegated to the past. The western mail trains that left Sydney last night had no longer to negotiate the tortuous track at Clarence to the valley beneath.

"How to carry a railway track across the Mountains" was a problem that the railway engineers of the sixties found great difficulty in solving. Eventually the Zig-zag scheme of Mr. John Whitton, was adopted. Mr. John Rae, in his appreciative biography of Mr. Whitton, says that if tunnels could have been adopted at the time it is not likely that Mr. Whitton would have undertaken the task of forming zig-zags. At that time the boring of tunnels was beyond the means of the State. The contract for constructing the Great Zig-Zag of 15 miles 10 chains, was let in May, 1860, and, exclusive of rails and other iron-work, and of station buildings, cost £328,284. As far back as 1855 the cutting out of the Zig-Zag became a live question. Money was voted for cutting out the Lapstone Zig-Zag, and in December 1892, this section of the work was completed, and the track opened through Glenbrook Tunnel. It is over two years now since the work of cutting out the Lithgow Zig-Zag was put in hand. Upwards of 1500 men have been employed.

Briefly, the new deviation leaves the old line about a quarter of a mile on the Sydney side of Newnes, forming a half-circle to the left, and one faces Bourke, doubling back to Mount Victoria, and then in a westerly direction, generally, passing under the old line three-quarters of a mile on the Bourke side of Clarence tunnel, but 350ft below it. The whole scheme involves a "off" in 90 grade from where the deviation leaves the old line to the Eskbank coal stage. Section A of the work is now complete, and B section, another colossal undertaking, will no doubt be put in hand when the duplication schemes are receiving attention. In the section just completed there are ten tunnels with double tracks. The length of the new deviation is some 5½ miles, and the route was decided as the best of those that had been surveyed. The surveyor responsible for this track was Mr. T. Kennedy. The tracks are well made, and the cuttings and the tunnels driven through solid sandstone are now completed. The work has cost roughly about £350,000.

Originally it was intended that there should be 11 tunnels in the section completed but by putting in a deep cutting one was avoided. One cutting is 160ft high from the cutting to the top, while another is 135ft, and Dinan's cutting is 200ft high—the deepest of its kind in the Commonwealth. The length of the tunnels vary, but they come after one another in rapid succession. In the whirl down between the spaces separating them the train passengers will see some new views of mountain scenery.

The new deviation will lessen the journey to and from the west by about 30 minutes, and the times of the starting of trains have been adjusted accordingly. The old Clarence station, with its well-known and admired station garden, will be cut out. The old stations at Bell, Clarence, and Zig-Zag will be closed, and new stations brought into use at Newnes Junction and Bell, while there will be a new unattended platform known as Clarence.

MELBOURNE, S.

The Postmaster-General stated on S that the new South African union had to accept from the Commonwealth bearing 2d postage. Previously the to Cape Colony was 2½d. The new a ment is to come into operation on Ne

L The Minister intends next week to duce into the House of Representatives Penny Postage Bill. The Prime M Mr. Fisher, in his Budget statement, said the promised penny postage would be r for Australia, but would extend to co oversea. If the bill does not make postage universal, it is expected that at least embrace Great Britain and the dominions. In that case, South Africa be included. The penny postage arran will not, however, be brought into op before May 1 next.

## FEDERAL NOTE ISSUE.

### PRINTING STARTS TO-DAY.

MELBOURNE, Su

To-morrow the Federal Government begin to print the Australian notes. more clear, the notes belonging to rious States will have the Commonwealth endorsement printed on them. Subse the Federal Government will print paper money. A guard of four men Royal Australian Artillery will take quarters at the Federal Treasury, and of the soldiers, with fixed bayonet, wa and down the outside of the building small presses inside will be turning ou dreds of pounds worth of money at The note paper to be used is on call banks in Melbourne. Probably the be put through the machines will notes of the Bank of New South Wales will be ready for re-issue to the banks immediately after they have been en It is not intended to furnish each ban its own notes again. Once the note been through the Federal press the Co wealth is liable for redemption, and the will thereafter be issued without distinc the banks as they are applied for. Al the notes are to be issued to the bank next week, they are not to be formally b into public circulation until December. The banks are to be allowed three thereafter before the tax of 10 per ce the issue of their notes comes into ope

## JAPANESE POLICY.

### KEEPING PEOPLE AT HOME.

### NEW CONSUL INTERVIEWED.

BRISBANE, Su

Mr. Miki Salto, who has been appoin act as Japanese Consul-General in pl Mr. S. Uyeno, arrived in Brisbane Yawata Maru to-day. In reply to a qu with reference to the recently formulate gration policy of the Japanese Gover he said that the Government's sole al was to keep the Japanese on Japan to send its labourers who hitherto hav to foreign countries overseas to Formo Korea. That is only a temporary he was asked.



# THE TEN TUNNELS DEVIATION

**B**y 1907 traffic on the Great Zig Zag had reached saturation point and its limited capacity was effectively preventing any expansion of goods and passenger services to the west. Improvements were made to the Zig Zag but these could only be stop-gap measures until a decision was made on an alternative route.

The plan finally adopted has since become known as the Ten Tunnels Deviation. Originally eleven tunnels were planned but one was discontinued after work had started and it was blown apart to create one of the deepest railway cuttings in Australia, just over 60 m deep. There are also two other cuttings over 40 m deep.

Work commenced on the new route on 1 June 1908, more or less simultaneously at both ends and in the middle. Using a workforce of over 1 500 men, construction was completed in just over two years and, with experienced miners engaged on tunnelling, there was only one fatality on the whole project. The deviation commenced about 2 km on the Sydney side of Newnes Junction and rejoined the original line near Bottom Points (see map p.75). The grade over the new section, double-tracked throughout, was a uniform 1 in 90 over the full length of almost 9 km.

The tunnels, known to steam men of old as the 'rat holes', vary in length from 79 m (No. 9 tunnel) to 789 m

(No. 10 tunnel). Over 570 000 cubic metres of earth and rock was removed from the cuttings and over 180 000 cubic metres of rock from the tunnels.

A special powerhouse was built near Newnes Junction to provide electricity to the drills, compressors and water pumps and a funicular railway was constructed on the eastern side of Mount Sinai to lower materials to the inaccessible area between tunnels 9 and 10. A small crane locomotive was also lowered to the same area. Bits and pieces and re-assembled to work on the isolated track. Numbered 1047, it was scrapped in 1968 and by coincidence bore the same number as one of the former Queensland locomotives now operating on the Zig Zag.

The new line opened for traffic on 16 October 1910 and reduced running time to Lithgow by 30 minutes. The old stations at Bell, Newnes Junction, Clarence and Zig Zag were closed and new stations opened at Bell, Newnes Junction (closed 6 April 1975) and Clarence (closed 21 September 1974). The deviation also meant that the highest point on the western line was now attained between Bell and Newnes Junction at a height of 1 092 m.

With the completion of this section almost the whole line between Sydney and Bowenfels was now double-tracked. The exception was the portion between Emu Plains and Blaxland which was completed in 1913.



# THE FORGOTTEN ZIG ZAG YEARS AND THE PASSING OF STEAM

With the by-passing of the Great Zig Zag, goods train loads from Lithgow increased over the years from the 274 tonnes hauled by the J.483 class engine to 1 100 tonnes with the Mountain (4-8-2) type D.57's, first introduced in 1929.

The D.57 was one of the most powerful locomotives ever built in Australia, weighing over 241 tonnes and with a tender holding over 41 000 litres of water and 14 tonnes of coal. The boiler rested on a giant steel frame cast in one piece in the United States and a mechanical stoker was used to feed the giant firebox. With their three cylinder engine giving an 'off-beat' exhaust note they were affectionately known throughout the mountains as 'Lazy Lizzies'. Twenty-five of these mammoths were built by the Clyde Engineering Company (tenders built by Mort's Dock and Engineering Company) but due to their considerable weight and heavy axle-loading they were restricted to main line work only - south to Junee, south coast to Thirroul and west to Lithgow.

In 1949 the railways introduced a 1 524-tonne maximum load for a D.57 between Lithgow and Enfield Yard, assisted in front and rear from Lithgow to Zig Zag and in front from Zig Zag to Blackheath. In practice, this meant that either two D.57's, or one D.57 and two standard goods engines headed the train, assisted in both cases by a standard goods engine at the rear. On the main line curve below the Zig Zag, over a grade of 1 in 42 and with up to four engines operating on one freight train, some of the most spectacular railway sights of the country were a daily occurrence. Clouds of steam and smoke rose from the straining engines while the discordant racket produced by their exhausts echoed from crag to crag in the small valley.

Another big engine appeared on the Western Line in 1947 when the C.38 class Pacific type express passenger engine was rostered to haul the Central West Express.

In 1950 a second Mountain type engine, the D.58, was

introduced on the Sydney/Lithgow run. Based almost entirely on the D.57 design, there were nevertheless sufficient modifications to make them less successful in operation than the mighty 'Lazy Liz'.

Beyer, Peacock Garratt AD.60 class engines were introduced in 1952. These giants had a wheel arrangement of 4-8-4 + 4-8-4 and weighed 269 tonnes, yet their relatively light axle loading enabled them to operate goods trains on light country branch lines. These Garratts were the largest and most powerful steam locomotives to operate in Australia but even as they were being delivered the days of steam were numbered, with the first of the 40 class A1A-A1A diesel locomotives entering service between Enfield and Broadmeadow on 30 November 1951. At about the same time the 40 class were introduced, electrification of the western line began from Parramatta and 40 electric locos (46 class) were ordered for service to Lithgow. Suburban trains ran to Penrith in October 1955 and electric engine-hauled trains to Valley Heights in November 1956, to Katoomba in February 1957 and Mount Victoria in March of the same year. Electrification to Lithgow was completed on 9 June 1957 when multiple unit electric trains took over regular passenger schedules between Sydney and Lithgow, leaving the 46 class to haul additional passenger services and long distance and freight trains.

Thus it was that steam on the mountains passed into history, as had the Great Zig Zag almost half a century earlier.

However, steam trains continued to operate west of Lithgow for many years but their duties were gradually eroded as more and more diesels came into service, first taking over passenger expresses and eventually all services. The last steam engine in traffic in New South Wales, and also the last in government service in Australia, was the AD.60 class Garratt No.6042. It was withdrawn from service on 18 March 1973.



# Railways of Australia

by C. C. Singleton  
and David Burke

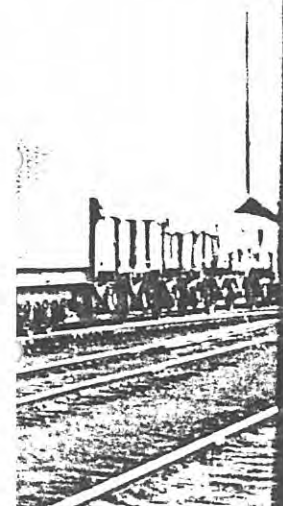


Angus and Robertson

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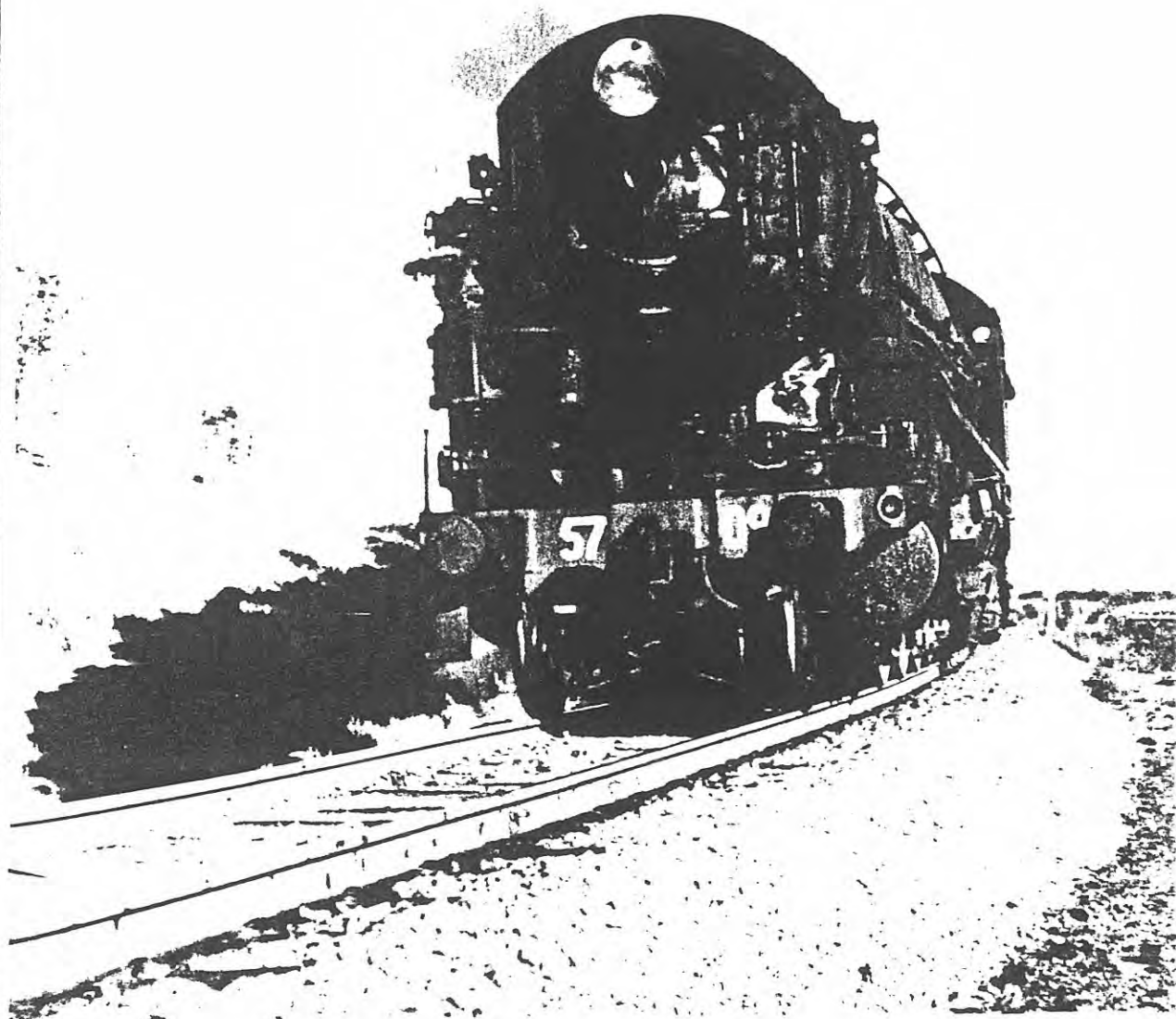


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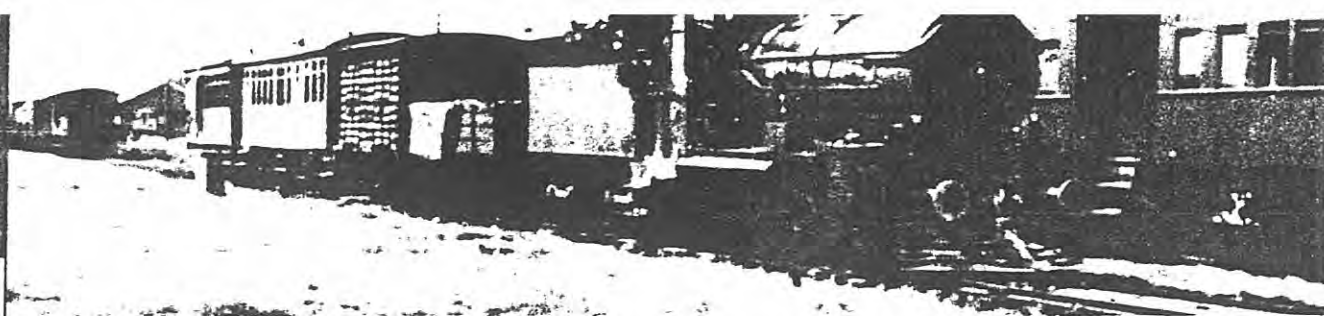
ys' 500B class  
ulling a hybrid  
59,000 lb.

IONEL E. BATES  
N COLLECTION)



*Mountain type 5709 of the New South  
Wales Railways; its weight—227 tons.*

A. R. LYELL

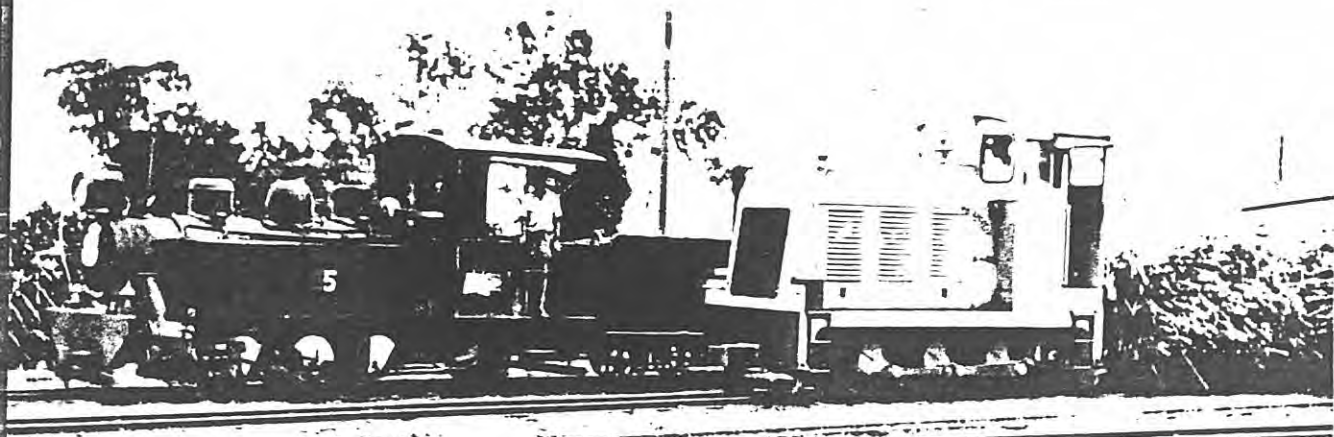


*The Aramac Shire Tram, its locomotive sparkling 4-6-0 A1, sets out from Barcal-dine in Central Qld. Now it is diesel.*

K. ROGERS

*Below: Clyde 0-6-0 diesel overtakes Perry 0-6-2 steam on Proserpine Mill tramway, Queensland.*

GEOFF GRANT



## List of Locomotive Classes in Order of Appearance

### STEAM

#### List of Locomotive Classes in Order of Appearance

ALL lists are set out in this sequence: FIRST YEAR in use; CLASSIFICATION (for some New South Wales Locomotives both old and 1924 classifications are shown); WHEEL ARRANGEMENT; SERVICE; CYLINDERS, in inches; DRIVING WHEEL diameter; PRESSURE, in pounds to the square inch; TRACTIVE EFFORT, in pounds; WEIGHT, in tons; BUILDERS; TOTAL NUMBER in class (x shows that all are out of service, xp that one is preserved); REMARKS.

### NEW SOUTH WALES

*Gauge 4 ft 8½ in.*

- 1855: 1; 0-4-2; mixed; 16 x 24 inside; 5' 6"; 120; 8,900; 46; Stephenson; 4 x; ordered for Sydney Rly Co.  
 1856: 5; 0-4-2; mixed; 14 x 22 inside; 4' 6"; 120; 7,700; 31; Hawthorn; 1 x; No. 5, ex contractor.  
 1856: 6; 2-2-2; pass.; 15 x 22 outside; 5' 6"; 120; 7,300; 39; Fairbairn; 2 x.  
 1857: 5; 0-4-2; mixed; 14 x 24 inside; 4' 6"; 120; 8,400; 33; Fairbairn; 1 x; No. 4N, ordered for Hunter R. Co.  
 1857: 1N; 0-4-2; mixed; 16 x 24 inside; 5' 6"; 120; 8,900; 46; Fairbairn; 3 x.  
 1858: 9; 2-2-2; pass.; 15 x 20 outside; 5' 9"; 120; 6,900; 34; Wilson-Manning Wardle; 4 x.  
 1859: 8; 2-2-2WT; subn.; 15 x 20 outside; 5' 6"; 120; 7,400; 30; Wilson-Manning Wardle; 2 x.  
 1863: 13; 2-4-0; mixed; 16 x 22 outside; 5' 0"; 120; 10,100; 41; Manning Wardle; 2 x.

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1892: 1-1  
1892: P-6  
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1893: J-5  
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1896: T-5

- Neilson Reid (10), Dubs (5), North British (84), Clyde, N.S.W. (50), 2001: 7; superheated with 180 lb. press. and T.E. incr. to 34,800 lb.
- 1896: CC-79, Z.13: 4-4-2T; subn.: 18 x 24 outside; 5' 6"; 140; 13,100; 52; see C-79 class: 20 xp; convt. from 4-4-0 C-79 class.
- 1902: A/E, Z.20: 2-6-4T; mixed; 18 x 24 inside; 4' 0"; 150; 19,400; 57; Beyer Peacock (12), Vale, N.S.W. (2), Eveleigh (7 new); 21; 14 convt. from 0-6-0 A-93 class, 7 built new.
- 1903: S-636, C.30: 4-6-4T; subn.: 18½ x 24 outside; 4' 7"; 160; 19,100; 72; Beyer Peacock (95), Eveleigh (50); 145; 77 convt. to 4-6-0 C.30T class from 1928.
- 1903: CG, Z.14: 4-4-0; mixed; 18 x 24 outside; 5' 9"; 140; 12,400; 62; Beyer Peacock: 9 xp; convt. from G-23 class.
- 1905: CG, Z.14: 4-4-0; mixed; 18 x 24 outside; 5' 6"; 140; 13,100; 62; Beyer-Peacock: 4 x; convt. from G-23 class.
- 1909: N-928, C.34: 4-6-0; expr.: 21 x 26 outside; 5' 9"; 180; 23,900; 109; Eveleigh Wks: 5 x.
- 1910: Q-158; 4-4-0; mixed; 16 x 24 inside; 5' 0"; 140; 11,400; 59; Beyer Peacock: 6 x; convt. from 4-4-0T, sold to Commonwealth 1913.
- 1912: TF-939, D.53: 2-8-0; goods; 21 x 26 outside; 4' 3"; 160; 29,000; 114; Clyde, N.S.W. (160), Eveleigh (30); 190; when superheated T.E. incr. to 33,600 lb.
- 1914: NN-1027, C.35: 4-6-0; expr.: 22½ x 26 outside; 5' 9"; 180; 29,200; 125; Eveleigh Wks: 35.
- 1917: G-1204, Z.27: 2-6-0; goods; 18 x 24 outside; 4' 0"; 160; 20,700; 80; Hunslet: 8; ex P.W.D.
- 1917: F-1212, X.10: 0-4-0ST; loco.; 12 x 18 outside; 2' 6"; 160; 9,200; 21; Manning Wardle: 1; ex P.W.D.
- 1917: V-1217, X.10: 0-4-0ST; loco.; 12 x 18 outside; 2' 6"; 165; 9,500; 27; Vulcan, U.S.A.: 2; ex P.W.D.
- 1918: K-1353, Z.55: 2-8-0; goods; 22 x 26 outside; 4' 3"; 160; 33,600; 127; Clyde, N.S.W.: 120.
- 1925: C.36; 4-6-0; expr.: 23 x 26 outside; 5' 9"; 180; 30,500; 159; Eveleigh (10), Clyde, N.S.W. (65); 75.
- 1928: C.30T; 4-6-0; mixed; 18½ x 24 outside; 4' 7"; 160; 19,120; 86; see C.30 class; 77; convt. from 4-6-4T C.30 class.
- 1929: D.57; 4-8-2; goods; 23½ x 28, 2 outside, 1 inside; 5' 0"; 200; 56,000; 228; Clyde, N.S.W.: 25 xp.
- 1943: C.38; 4-6-2; expr.: 21½ x 26 outside; 5' 9"; 245; 36,200; 201; Clyde, N.S.W. (5), Railway Wks (25); 30.
- 1950: D.58; 4-8-2; goods; 21½ x 28, 2 outside, 1 inside; 5' 0"; 200; 56,000; 228; Eveleigh Wks (11), Cardiff Wks (2); 13 xp.
- 1952: D.59; 2-8-2; goods; 21 x 28 outside; 5' 0"; 200; 33,000; 150; Baldwin: 20.
- 1952: AD.60; 4-8-4 — 4-8-4; goods; 19½ x 26, 4 outside; 4' 7"; 200; 59,600; 254; Beyer Peacock; 42; Beyer Garratt. Several raised to 63,000 lb. T.E.

#### VICTORIA

##### Gauge 5 ft 3 in.

- 1859: No. 12; 2-2-2; pass.: 14 x 22 inside; 6' 0"; 100; 4,800; —; Geo. England; 1 x; unclassified, convt. to 2-4-0 1870.
- 1859: 1st V; 0-6-0; goods; 16 x 22 inside; 5' 0"; 130; 9,800; 49; Geo. England; 4 x.
- 1860: P; 0-6-0; goods; 16 x 22 inside; 5' 0"; 130; 9,800; 53; Beyer Peacock: 5 x.
- 1860: Old J; 2-2-2; pass.: 15 x 22 inside; 6' 0"; 120; 6,500; —; Beyer Peacock: 5 x; convt. to 2-4-0 1872.
- 1860: 34 & 36; 2-2-2WT; pass.: 12 x 20 outside; 6' 6"; 120; 3,600; —; Stephenson: 2 x; ex Geelong & Melbourne Rly Co., No. 34 rebuilt as 0-6-0T 1872, No. 36 rebuilt as 2-4-0T 1872.
- 1860: 38, 40, 42 & 44; 2-2-2WT; pass.: 15 x 20 outside; 6' 6"; 120; 5,500; —; Stothert & Slaughter (2), Hawthorn (2); 4 x; ex Geelong & Melbourne Rly Co.
- 1860: 19 & 21; 0-6-0WT; goods; 15 x 20 outside; 4' 9"; 120; 7,600; —; Hawthorn: 2 x; ex Geelong & Melbourne Rly Co.
- 1861: L; 2-4-0ST; pass.: 16 x 22 inside; 5' 0"; 130; 9,380; 36; G. England (7), Slaughter-Gruning (3); 10 x.
- 1862: O; 0-6-0; goods; 17 x 24 inside; 5' 0"; 130; 12,000; 64; Slaughter-Gruning (6), Stephenson (12), Beyer Peacock (11), Yorkshire (6), Williamstown (2), Phoenix (7); 44 x.
- 1862: B; 2-4-0; expr.: 16 x 24 inside; 6' 0"; 125; 8,500; 63; Beyer Peacock (19), Hawthorn (13), Phoenix (2); 34 x.
- 1870: No. 12 (convt.): 2-4-0; pass.: 14 x 22 inside; 5' 0"; 100; 4,800; —; Geo. England; 1 x; convt. from 2-2-2 of 1859.
- 1872: E100; 2-4-0; pass.: 16 x 22 inside; 5' 0"; 140; 10,500; 57; Williamstown Wks: 1 x; unclassified in 1889.
- 1872: Old J (convt.): 2-4-0; pass.: 15 x 22 inside; 5' 0"; 130; 8,600; 50; Beyer Peacock: 5 x; convt. from 2-2-2 J class.
- 1873: Q; 0-6-0; goods; 16 x 24 inside; 4' 6"; 130; 11,700; 55; Phoenix: 10 x.
- 1873: 103, 105; 0-6-0; goods; 16 x 22 outside; 3' 6"; 140; 15,000; 47; Williamstown: 2 x; unclassified 1889.
- 1874: F; 2-4-0; pass.: 15½ x 20 inside; 5' 0"; 130; 8,200; 50; Phoenix: 21 x; 7 convt. to 2-4-2T FE class 1910.

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# GETTING THROUGH...

## Road Tunnels on New South Wales Main Roads

Tunnels may conjure in the mind images of daring prison escapes, smuggling, or perhaps scenes from Jules Verne's "Journey to the Centre of the Earth". Yet tunnels regularly perform far wider uses and functions, from carrying pipelines of oil, gas or water, to providing rail and road access.

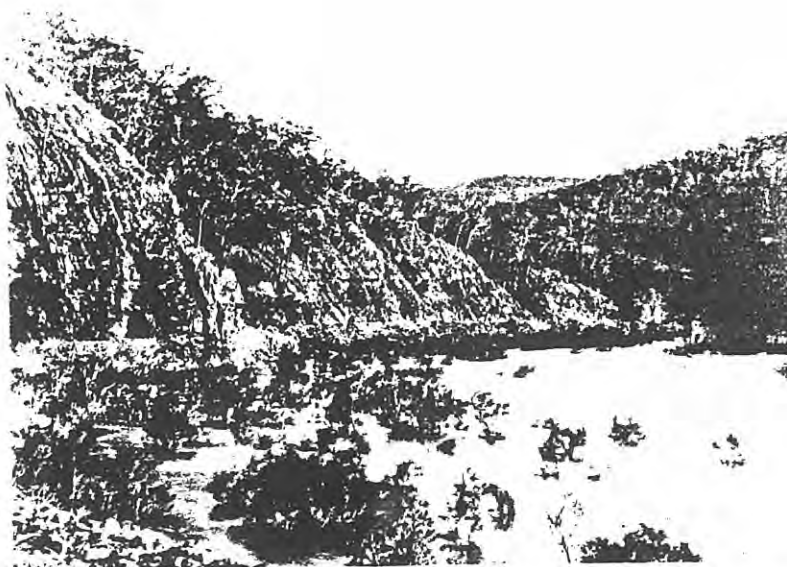
The world's longest road tunnel, beneath the Swiss Alps at Goschen, is over 16 km long. Even at autobahn speeds, it takes more than nine minutes to traverse. Compared to this sample, none of our tunnels would give the subterranean traveller even a slight twinge of claustrophobia.

Motorists in New South Wales need little reminder that there are, fortunately, far fewer high mountainous areas in our State than in Europe. Consequently, there has been much less need for tunnels to be constructed. For a summary of the variety of road tunnels which are to be found in New South Wales, some brief notes follow.

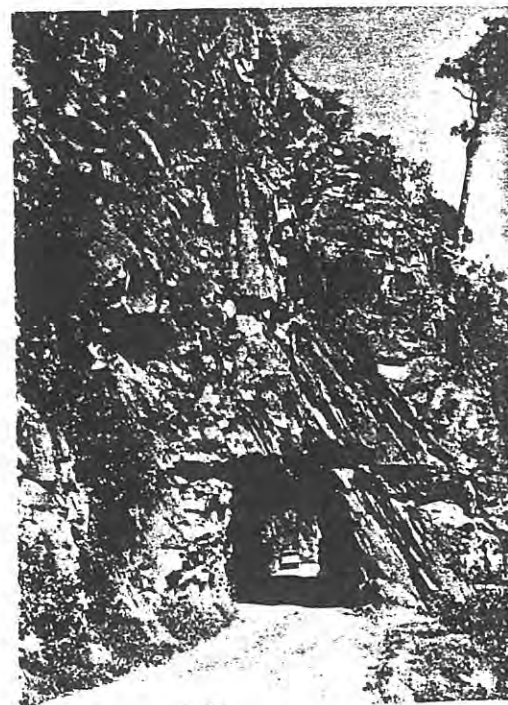
### Wombeyan Caves Road

The Wombeyan Caves in the New South Wales southern highlands are thought to have been discovered by Rev. J. Hassall in 1842 or 1843, when he visited the district with his schoolmaster, Rev. Troughton (New Nation Magazine, June 1930, p. 51). On Main Road No. 258, which leads to the caves, lies a tunnel which an early report mentions "... the road passes through a tunnel cut through the sandstone ridge, and runs under the shadow of weather-worn and precipitous rocks which tower overhead and form the southern escarpment of the range ..." (Guide to Wombeyan Caves, 1906, O. Trickett, p. 9.)

According to the Department of Public Works' Annual Reports, construction of the road began in 1890 and took more than ten years to complete. The one-lane 20m-long tunnel along the route was hewn by hand into a surprisingly smooth arch.



The "Sweeneys" tunnel, cut through this rugged hillside, is on the old route of the Gwydir Highway which, at this point, runs alongside the Boyd River.



MAIN ROADS, SEPTEMBER 1971



### "Sweeneys" on the old Gwydir Highway

Between Dalmorton and Newton Boyd on the old route of the Gwydir Highway, a 60m-long tunnel was built near an area known locally as "Sweeneys". Excavated through hard igneous rock, this work was conducted by the Department of Public Works under the supervision of David Howison as engineer-in-charge.

Work commenced in 1866 with the primary aim of eliminating a circuitous path around a spur. This route was the major link between farms in the district and the markets at Grafton.

The *Clarence and Richmond Examiner* of 27 November 1866, reported: "The tender of Mr. H. P. Wiseman for contract No. 1 at the Big Hill on the Newton Boyd line road has been accepted by the Government and the work will be proceeded with forthwith." The same paper reported on 20 October 1868: "The tunnel at Sweeneys through blue trap, is well advanced towards completion . . ."

This section of the highway was in service until 9 December 1960, when a new route over Gibraltar Range was opened from Grafton to join with the old route near Mitchell.

### Lithgow Zig-Zag

The western railway line was constructed across the Blue Mountains under the charge of John Whitton, engineer-in-chief of the New South Wales Government Railways. It was decided to incorporate a zig-zag to descend the steep western escarpment of the Blue Mountains, into the Lithgow Valley. In its day, it was considered one of the world's engineering marvels, involving some extremely heavy rock cutting and having fine, tall stone viaducts with semi-circular arches. The zig-zag involved 6 km of track, eight viaducts, four tunnels and 268 culverts. The vertical drop that the zig-zag negotiates is 210m.

The railway opened in 1869 and remained in use until 1910, when a new line was opened on an easier grade. The old route remained, and a road was adapted to the railway right-of-way, connecting it to the Lithgow-Bell road. This roadway was proclaimed as Tourist Road No. 4011 in 1962. The road terminated at a 70m tunnel which formed part of the original zig-zag.

The old railway route has again become a major tourist attraction with the introduction of steam locomotives which provide joyrides along part of the zig-zag. (See also *Main Roads*, September 1967, Vol. 33, No. 1, pp. 17-18.)

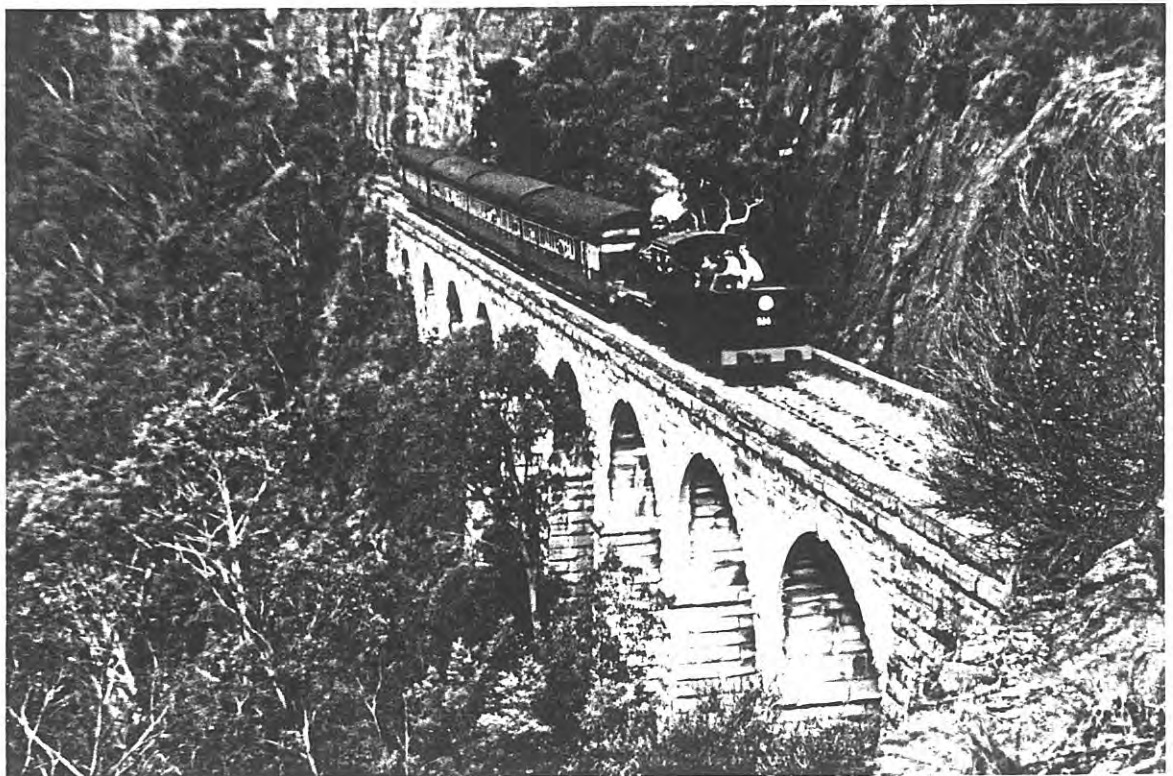
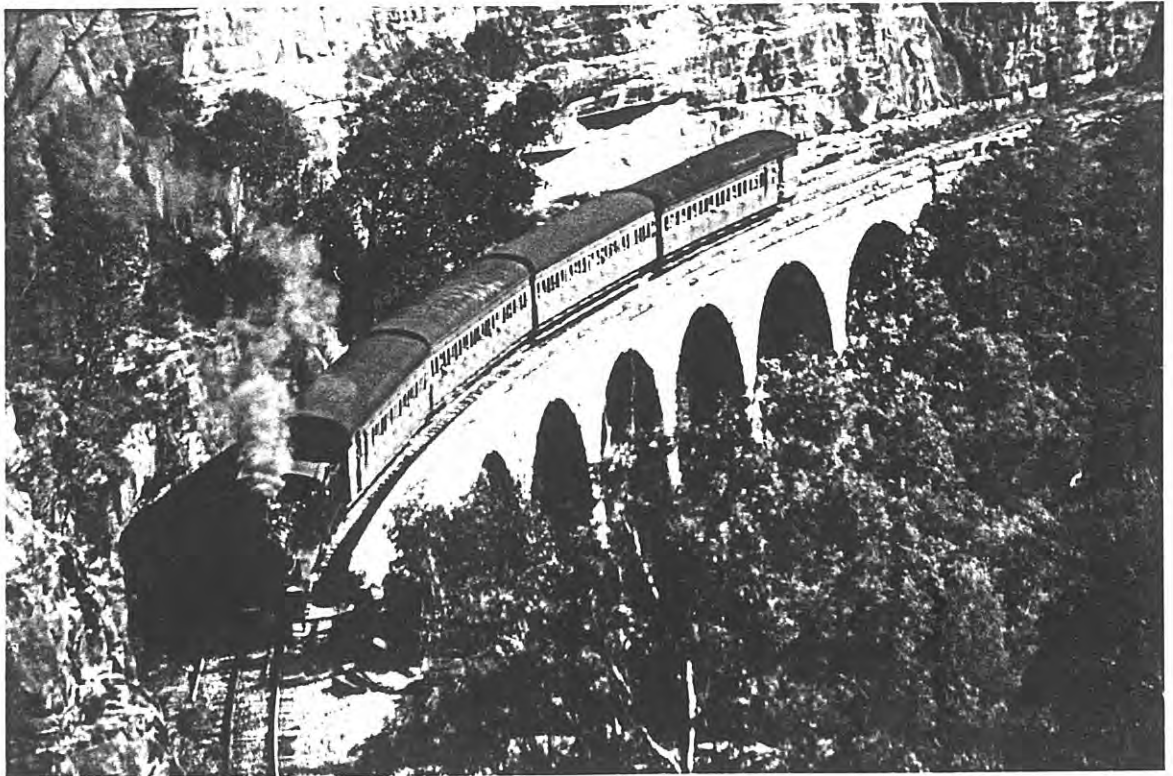
One of the stone, elliptical viaducts incorporated in the Lithgow Zig-Zag which negotiates a steep vertical drop on the western side of the Blue Mountains.



A hand-hewn tunnel cut through a ridge on Main Road No. 258. The route leads to the Wombeyan Caves, situated to the west of Mittagong.



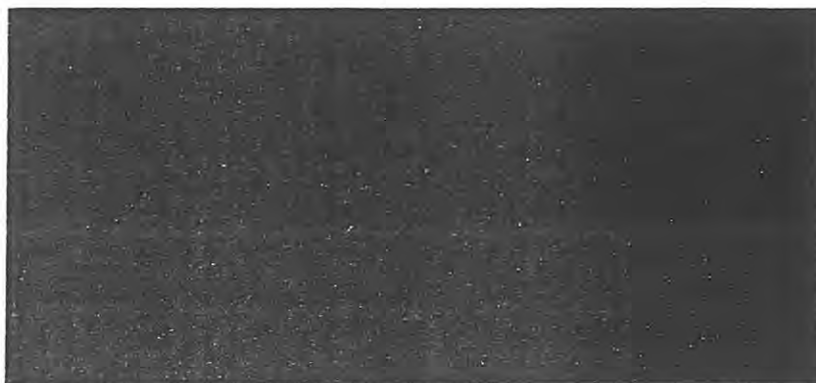
AS A TOURIST ATTRACTION



# Tourist Roads



*The tunnel entrance on the disused railway*



MAIN ROADS

## TO HISTORIC ZIG ZAG RAILWAY

The now abandoned zig zag railway, which descends into the Lithgow Valley on the western slopes of the Blue Mountains, was a remarkable engineering feat, attracting world attention.

When the then Engineer-in-Chief of the Railways Department, Mr John Whitton, constructed the western railway line across the Blue Mountains it was decided, because of the steep slopes, to construct zig zags at Glenbrook and near Lithgow.

The zig zag is a type of railway construction designed to negotiate very abrupt inclines. The lines are laid in one or more "Z's" with reversing points where the line doubles back to enable the train to reverse its direction.

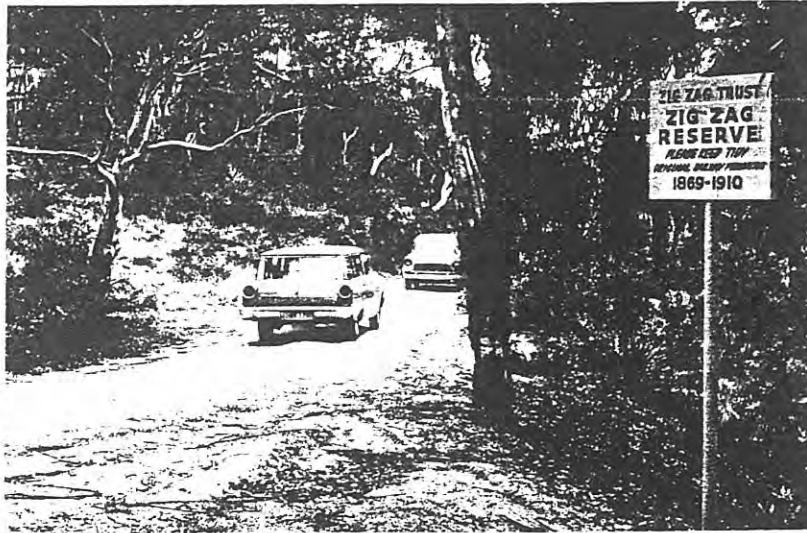
The Glenbrook Zig Zag was part of the ascent of Lapstone Hill and was opened in 1867. Twenty-five years later it was replaced by a tunnel which in turn was replaced by a deviation via Glenbrook Gorge: the latter was brought into service in 1913.

The more spectacular Lithgow Zig Zag was opened in 1869. It involved some extremely heavy rock cutting and included three fine stone viaducts with semi-circular arches and a 230 feet long tunnel. The vertical drop between the terminal points of this zig zag is 687 feet. It remained in use until 1910 when a new route was opened on an easier grade. This involved ten tunnels and incorporated the lower section of the zig zag.

The upper section fell into disuse but was visited by tourists who came to view the old railway. In 1947 it was placed under the administration of the Hassans Walls and Zig Zag Trust. Subsequently a road on the railway right of way was graded for use by road traffic, connecting it to a road link with the Lithgow-Bell Road (Main Road No. 516).

The reserve in which the zig zag is situated was originally included in the area of the Shire of Blaxland. In 1966 it was incorporated within the City of Lithgow.



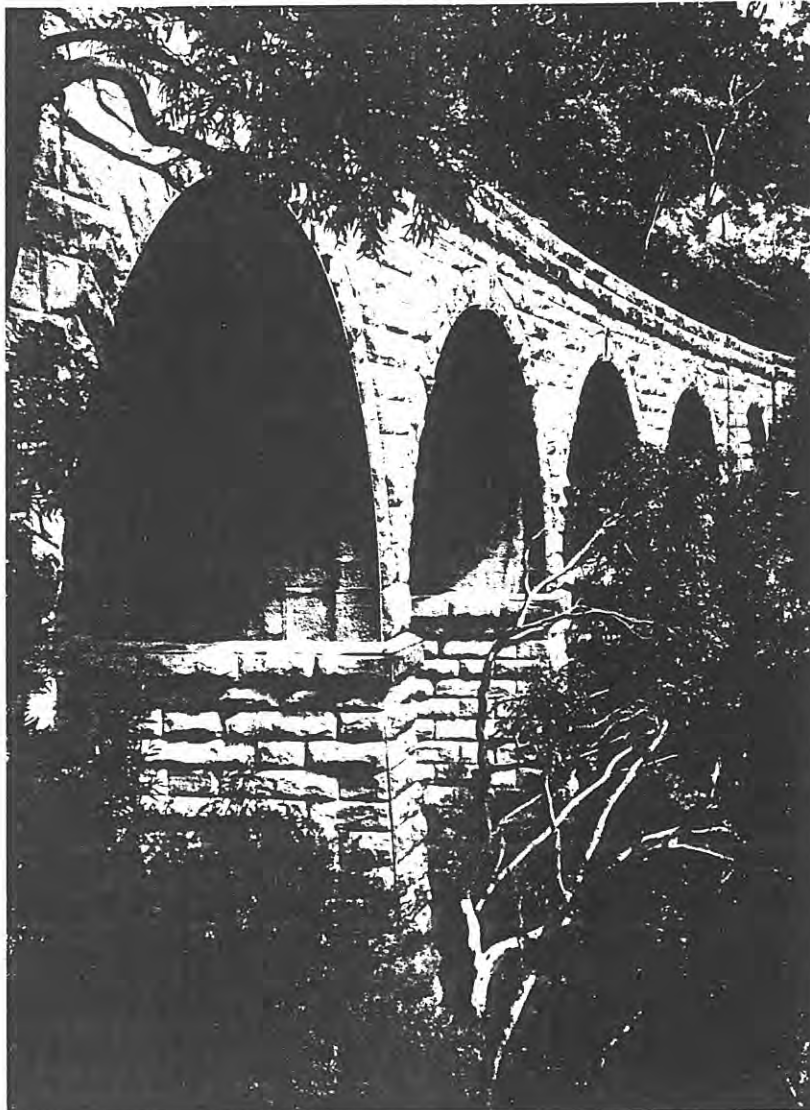


Left: Section of Tourist Road leading to the Zig Zag Railway

Below left: One of the stone viaducts which carried the railway over the zig zag

Right: Three sections of the Zig Zag can be seen in this photograph. The existing railway uses the lower section of the old route

Below right: The obelisk at Captain Cook's Landing Place



In 1961 both Blaxland Shire Council and the Lithgow City Council applied for Tourist Road classification for the road connecting the Zig Zag to the Lithgow-Bell Main Road.

Recognizing that this road provides access to an engineering feature of some historic interest, including several scenic lookouts and a picnic area, the Department of Main Roads agreed to proclaim it as a Tourist Road. It was subsequently proclaimed Tourist Road No. 4011 in 1962. Its length is approximately one mile.

The estimated cost of bringing the road to reasonable order suitable for tourist traffic is in the order of \$8,000. The Department has allocated half the estimated cost (\$4,000) towards reconstruction. Some of this work was carried out by Blaxland Shire Council when the road was located within that area. A current grant has been made by the Department to the Lithgow City Council to complete the work.

#### AT CAPTAIN COOK'S LANDING PLACE

The road from Captain Cook Drive through the Captain Cook's Landing Place Park to Cape Solander is Tourist Road No. 4031. It is wholly located within the Park which is administered by a Trust; the Park is situated on the peninsular south of Botany Bay within the local government area of the Shire of Sutherland.

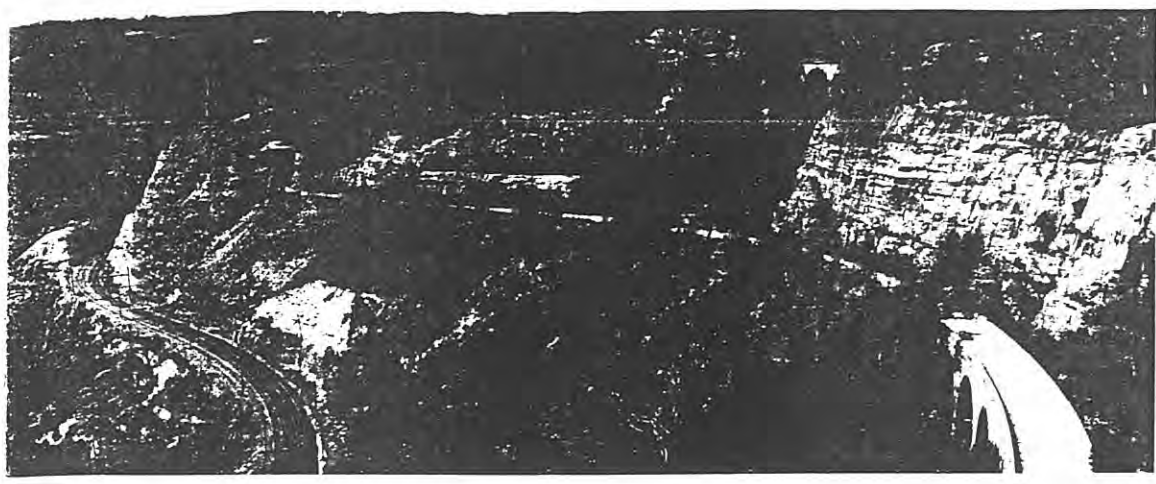
Captain Cook's Landing Place Park is a proclaimed public park consisting

on of Tourist Road leading to  
Railway

One of the stone viaducts  
of the railway over the zig zag

sections of the Zig Zag  
in this photograph. The  
way uses the lower section  
note

The obelisk at Captain  
Cook Place



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Lithgow City Council applied  
Road classification for the  
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ell Main Road.

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an engineering feature of some  
erest, including several scenic  
nd a picnic area, the Depart-  
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road was located within its  
rent grant has been made by  
ment to the Lithgow City  
complete the work.

# CAPTAIN COOK'S PLACE

from Captain Cook Drive,  
rough the Captain Cook's  
ice Park to Cape Solander is  
ad No. 4031. It is wholly  
in the Park which is adminis-  
trated; the Park is situated on  
lar south of Botany Bay  
ocal government area of the  
therland.

Cook's Landing Place Park  
ned public park consisting of

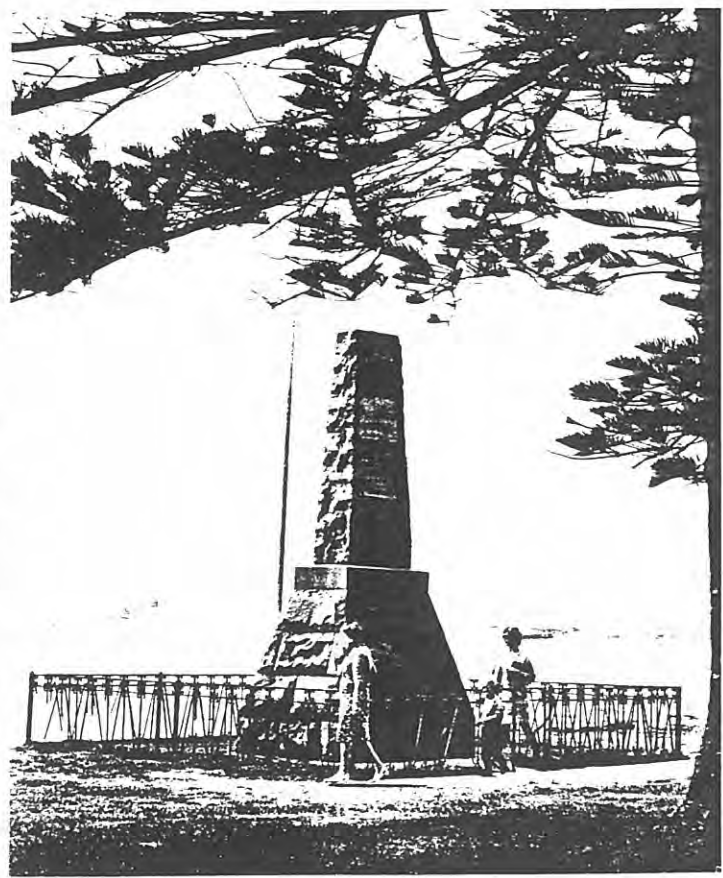
240 acres dedicated in 1899 and a further  
12 acres reserved in 1946. The State  
Government is proposing to increase this  
area substantially under pending legis-  
lation.

The Park is extremely popular and  
attracts many visitors. Being the site  
where Captain Cook first landed on the  
east coast of Australia on 29th April,  
1770 it is of some historical significance.  
The Park Trust is carrying out con-  
siderable improvements to cater for  
tourists and picnickers.

For many years the only reliable access  
to the Park was by a launch service from  
La Perouse across the entrance to  
Botany Bay. This service was subject to  
interruptions in bad weather and could  
not accommodate the tourists that would  
normally be expected to visit the area.

In 1949 the Park Trust approached the  
Commonwealth Government seeking its  
assistance in building an access road to  
the Park, from Cronulla to Kurnell.  
However, the Commonwealth advised  
that it could not assist. Similar represen-  
tations were made to the State Govern-  
ment with the same result. Ultimately a  
rough track over the sand dunes was  
made but it was only suitable for four-  
wheel drive vehicles. Subsequently, the  
Sutherland Shire Council constructed a  
bitumen surfaced road to Kurnell from  
Commonwealth Aid Roads funds. This  
road was completed in 1953 and is named  
Captain Cook Drive. At its northern end  
it is adjacent to the Park boundary.

In 1963 the Park Trust made represen-  
tations to the Department of Main



# THE ZIG ZAG RESERVE AND TOURIST RAILWAY PROJECT

From the time of its opening the Zig Zag attracted visitors and to cater for them, Bottom Points station was opened on 15 April 1878, with the whole area being proclaimed a public reserve on 14 March 1881. This reserve of 722 hectares extends from Lithgow Valley to Clarence tunnel. When the Ten Tunnels Deviation was opened in 1910 the old formation soon became overgrown and it was not until 1939, when the present main road from Lithgow to Kurrajong was built, that the area again became reasonably accessible, although it was to be another ten years before Top Road was cleared of all obstructions. During the next fifteen years improvements continued to be made as the old formation was completely cleared and picnic areas were established.

In 1967/68 a group of young enthusiasts, headed by Ian Thornton, were keen to establish a steam tourist railway in New South Wales and help preserve for all time the splendour and fascination of steam. The Great Zig Zag was chosen as the most suitable site, not only because the railway would traverse magnificent viaducts and afford spectacular scenery but also because of its accessibility for day-trippers from Sydney, located as it is, adjacent to a major highway and the main western railway. Abundant water supplies and availability of

coal were also an attraction. Negotiations commenced with the Zig Zag Trust in March 1969 together with representations to the Department of Lands and the Lithgow City Council. These dealings were protracted due to the need to acquire adequate finance and seek government approval for such an undertaking on a public reserve.

During 1969 a steering committee was formed and from this committee the Lithgow Switchback Railway Co-op. Ltd., was born in June 1972, becoming the Zig Zag Railway Co-op. Ltd., in 1974.

When originally built, the Zig Zag operated on a standard gauge of 1 435 mm (4' 8½") but the tourist railway uses narrow gauge 1 067 mm (3' 6"). The change of gauge came about because the then Commissioner for Railways would not make available New South Wales steam locomotives for preservation by private sources as he felt this would compete with the officially sponsored New South Wales Rail Transport Museum at Enfield, later Thirlmere. Under these circumstances the steering committee decided to approach Queensland Railways with a view to purchasing some of their surplus narrow gauge equipment.



## STEAM RETURNS TO THE ZIG ZAG

**L**ocomotive DD.17 No. 1046 successfully ascended the Middle Road of the Zig Zag between 2.00 p.m. and 4.00 p.m. on Friday 29 August 1975. A number of track problems were highlighted, these being corrected to enable another successful trial to be held on Saturday and Sunday, 18 and 19 October 1975, commemorating the 106th anniversary of the original Zig Zag which opened on 18 October 1869 and closed on Sunday 16 October 1910.

By September 1985 the tourist railway line had carried over half a million passengers and to cater for their needs, picnic and barbeque areas were provided as well as car parking facilities. All trains are crewed by drivers and firemen who are qualified by the Department of Industrial Relations and Technology, and guards undergo intensive training to ensure their capability in their important role. Maintenance of locomotives and rolling stock is also under the supervision of fully-trained staff. Train crews, maintenance and shop staff all perform their duties on a voluntary basis, and on pages 149, 150 and 155 many of these people are shown at one or another of their tasks, and in some lighter moments.

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## Extension to Clarence

On 22 February 1987 the last train operated to Top Points with much popping of champagne corks. Harold Fowle, one of Zig Zag's founding members, was the driver for this special occasion.

The line was then closed for five weeks while lines were laid and the new track ballasted between Top Points and Mount Sinai, where a temporary terminus was established. Trains then ran between Bottom Points and Mount Sinai while construction work continued towards Clarence, with the first ballast train passing through Clarence Tunnel on 19 June 1987. At Clarence, the new terminus, a station, sidings and engine run-round facilities were built.

The extension was officially opened on 29 October 1988, 119 years after the first train to travel the Zig Zag steamed through Clarence Tunnel and headed for the Great Zig Zag and Lithgow.

## GENERAL INFORMATION

**RECORDED INFORMATION** (24 hour service) For current information phone (02) 858 1480 or (047) 57-3061

**ENQUIRIES** For enquiries and group bookings, please phone: (047) 57-3061 during business hours, Monday to Friday, or (063) 52-2711 on weekends, Clarence Station - Train Operating days (063) 55 2690

**DISABLED PASSENGERS** Accommodation is available in the Guard's compartment for disabled passengers in wheel chairs.

**REFRESHMENTS** Souvenirs and chips, sweets, drinks, etc. are available at Clarence. Snacks and meals are available in Lithgow.

**PRAMS** Prams are carried free of charge. Non-folding prams will need to be placed in the Guard's compartment.

**DOGS** Dogs are permitted on the train but must be under the control of their owners at all times.

**TRAIN OPERATIONS** Trains will run in all weather. See Timetable information. Trains will not wait for latecomers.

**PICNIC STOPS** There are picnic and BBQ places along the line and the train will stop to let you off and pick you up afterwards. Please arrive at Clarence Terminal at least 15 minutes prior to departure to allow yourself time to buy tickets and arrange the special stop with the Guard.

**SPECIAL TRAIN HIRE** The train has been hired by both local and overseas organisations for T.V. shows, commercials and groups of enthusiasts. Details of hiring can be obtained by phoning: (047) 57 3061 during business hours.

## LITHGOW WORKMEN'S CLUB

*Lithgow's Home of Fine Food & Entertainment*  
**Eating Facilities Bistro/Carvery/Salad Bar**  
**For an Excellent Meal**

The Bistro/Carvery is the Place to Go  
Plus option of our Salad Bar

Plus Special Children's meals. Open every day Lunch & Dinner

## CHLOE'S COFFEE LOUNGE

Open during Trading Hours

Enjoy Quality Coffee & Tea. Variety of Sandwiches, Hot Snacks, Cakes & Pastries, Desserts, Drinks, Milkshakes

LITHGOW: 3 TANK STREET - (063) 52 2777

## HOW TO GET THERE BY CAR:

**FROM SYDNEY VIA GREAT WESTERN HIGHWAY & KATOOMBA**

Continue westward through Katoomba to Mt. Victoria and turn right to Bell, across the zoning C-100 highway turning left at Bell and continue towards Lithgow for 7Km.

**FROM SYDNEY VIA RICHMOND & BELLS LINE OF ROAD**  
Continue towards Lithgow from Richmond and veer right at Bell, Clarence terminal is 7km further west.

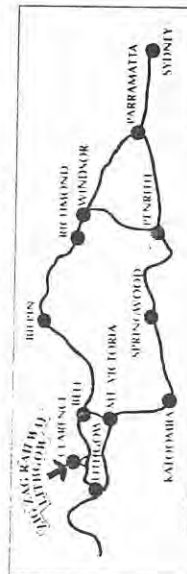
**FROM ORANGE, BATHURST & OTHER POINTS WEST**  
Turn left at Bowenfels following the signs to Windsor and Zig Zag Railway. Clarence Station is 10km east of Lithgow.

## BY TRAIN:

Electric Inter-City services between Sydney and Lithgow stop, on request, at the Zig Zag Platforms. The rail journey from Sydney takes a little under 3 hours. (See inside for timetable)

## PARKING:

A large car park is provided at Clarence Station. Parking is free. Ample room has been set aside for coaches.



*Pamper yourself with a stopover at the*

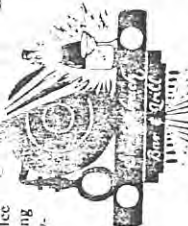
## Zig Zag Motel Lithgow

24 units individually heated/  
Cooled, Colour TV, Videos,  
ISD Direct-Dial Phones,  
Water Bed, Tea & Coffee  
making facilities, Parking  
at door, Pool & Play-  
ground.

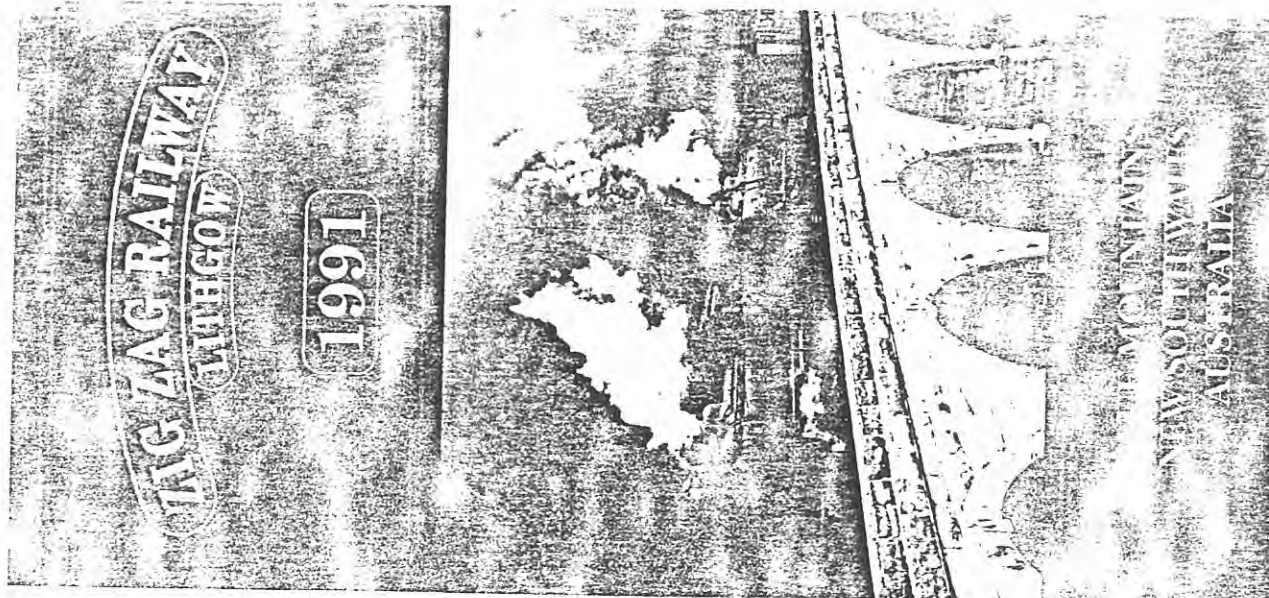
Only 6km from Zig Zag  
Railway on Bells  
Line of Road

N.R.M.A. RATED  
Standard Suites ♦♦♦♦  
Executive Suites  
♦♦♦♦♦

Try our Bar &  
Char Grill



Your Hosts Roger & Judy Fenton, (063) 52-2477





## THE GREAT LITHGOW ZIG ZAG

Constructed from 1866 to 1869, the Great Lithgow Zig Zag is acclaimed as a major engineering feat of its time. Early railway construction engineers faced the problem of how to lower the main western line from the top of the Blue Mountains escarpment at Newnes Junction, into the Lithgow Valley down a sheer precipice. It was decided to construct a zigzag in the shape of a large letter 'Z' on its faces, using 27 reversing stations known as Top and Bottom Points, by which trains could descend and climb without excessive gradients. The line passes through 2 tunnels and over 3 magnificent sandstone viaducts along its way.

In the event the turn of the century found rail traffic on the Blue Mountains very heavy, and the Zig Zag became a bottleneck. This forced the construction of a modern double line deviation through the escarpment, by means of 10 tunnels, on a steady climb from the bottom of Zig Zag to Newnes Junction. The Zig Zag then fell into disuse, the track was removed, and the site was soon reclaimed by the bush.

In 1975 saw the return of steam trains to the valley, over members of the Zig Zag Railway Co-operative relied track on the 15 km long Middle Road, and began limited train operations for the benefit of visitors. 1986-88 saw the re-laid on the Top Road as far as Clarence, where you will join the train if arriving by car. The Zig Zag Railway train descends from Clarence, passing through a long tunnel and around many curves, before arriving at Top Points. Here it reverses and descends Middle Road to Bottom Points. Whilst the locomotive is serviced here, passengers may be fortunate to see a heavy goods train, or even the Indian Pacific, hauled by modern electric locomotives, climbing the grade up the Bottom Road of Zig Zag which is still part of the main Sydney/Parramatta line. The highlight of the journey on Zig Zag is the return upgrade to Clarence, with the sight, sound and smell of a hard working steam locomotive sure to bring excitement to the young, and a touch of nostalgia to those who can remember when the nation travelled behind steam.

## THE ZIG ZAG RAILWAY CO-OPERATIVE, LIMITED

The Railway is owned, operated and maintained by the volunteer members of the Co-op who give their time to preserve and operate the railway over this very historic site. Membership is open to interested persons, and offers of labour or financial assistance are always welcome. Members have the opportunity to take part in all aspects of the railway, such as locomotive restoration, carriage repair, sales, building, and of course, operations. Indeed, the locomotive fireman may be a school teacher, and the ticket seller your bank manager! All revenue from ticket and souvenir sales is directed towards upgrading of the railway and its locomotives. The railway owns 7 steam locomotives and a wide variety of bogies and rolling stock.

We hope your visit to our railway will be a pleasant and memorable one. Thank you for your interest.

## TIME TABLE SELECTOR

| JANUARY |    |    |    |    |   |   | FEBRUARY |    |    |    |    |    |    | MARCH |    |    |    |    |    |    |
|---------|----|----|----|----|---|---|----------|----|----|----|----|----|----|-------|----|----|----|----|----|----|
| S       | M  | T  | W  | T  | F | S | S        | M  | T  | W  | T  | F  | S  | S     | M  | T  | W  | T  | F  | S  |
| 1       | 2  | 3  | 4  | 5  |   |   | 1        | 2  | 3  | 4  | 5  | 6  | 7  | 1     | 2  | 3  | 4  | 5  | 6  | 7  |
| 8       | 9  | 10 | 11 | 12 |   |   | 8        | 9  | 10 | 11 | 12 | 13 | 14 | 8     | 9  | 10 | 11 | 12 | 13 | 14 |
| 15      | 16 | 17 | 18 | 19 |   |   | 15       | 16 | 17 | 18 | 19 | 20 | 21 | 15    | 16 | 17 | 18 | 19 | 20 | 21 |
| 22      | 23 | 24 | 25 | 26 |   |   | 22       | 23 | 24 | 25 | 26 | 27 | 28 | 22    | 23 | 24 | 25 | 26 | 27 | 28 |
| 29      | 30 | 31 |    |    |   |   | 29       | 30 | 31 |    |    |    |    | 29    | 30 | 31 |    |    |    |    |

| APRIL |    |    |    |    |    |   | MAY |    |    |    |    |    |    | JUNE |    |    |    |    |    |    |
|-------|----|----|----|----|----|---|-----|----|----|----|----|----|----|------|----|----|----|----|----|----|
| S     | M  | T  | W  | T  | F  | S | S   | M  | T  | W  | T  | F  | S  | S    | M  | T  | W  | T  | F  | S  |
| 1     | 2  | 3  | 4  | 5  | 6  |   | 1   | 2  | 3  | 4  | 5  | 6  | 7  | 1    | 2  | 3  | 4  | 5  | 6  | 7  |
| 8     | 9  | 10 | 11 | 12 | 13 |   | 8   | 9  | 10 | 11 | 12 | 13 | 14 | 8    | 9  | 10 | 11 | 12 | 13 | 14 |
| 15    | 16 | 17 | 18 | 19 | 20 |   | 15  | 16 | 17 | 18 | 19 | 20 | 21 | 15   | 16 | 17 | 18 | 19 | 20 | 21 |
| 22    | 23 | 24 | 25 | 26 | 27 |   | 22  | 23 | 24 | 25 | 26 | 27 | 28 | 22   | 23 | 24 | 25 | 26 | 27 | 28 |
| 29    | 30 |    |    |    |    |   | 29  | 30 | 31 |    |    |    |    | 29   | 30 | 31 |    |    |    |    |

| JULY |    |    |    |    |    |   | AUGUST |    |    |    |    |    |    | SEPTEMBER |    |    |    |    |    |    |
|------|----|----|----|----|----|---|--------|----|----|----|----|----|----|-----------|----|----|----|----|----|----|
| S    | M  | T  | W  | T  | F  | S | S      | M  | T  | W  | T  | F  | S  | S         | M  | T  | W  | T  | F  | S  |
| 1    | 2  | 3  | 4  | 5  | 6  |   | 1      | 2  | 3  | 4  | 5  | 6  | 7  | 1         | 2  | 3  | 4  | 5  | 6  | 7  |
| 8    | 9  | 10 | 11 | 12 | 13 |   | 8      | 9  | 10 | 11 | 12 | 13 | 14 | 8         | 9  | 10 | 11 | 12 | 13 | 14 |
| 15   | 16 | 17 | 18 | 19 | 20 |   | 15     | 16 | 17 | 18 | 19 | 20 | 21 | 15        | 16 | 17 | 18 | 19 | 20 | 21 |
| 22   | 23 | 24 | 25 | 26 | 27 |   | 22     | 23 | 24 | 25 | 26 | 27 | 28 | 22        | 23 | 24 | 25 | 26 | 27 | 28 |
| 29   | 30 | 31 |    |    |    |   | 29     | 30 | 31 |    |    |    |    | 29        | 30 | 31 |    |    |    |    |

| OCTOBER |    |    |    |    |    |   | NOVEMBER |    |    |    |    |    |    | DECEMBER |    |    |    |    |    |    |
|---------|----|----|----|----|----|---|----------|----|----|----|----|----|----|----------|----|----|----|----|----|----|
| S       | M  | T  | W  | T  | F  | S | S        | M  | T  | W  | T  | F  | S  | S        | M  | T  | W  | T  | F  | S  |
| 1       | 2  | 3  | 4  | 5  | 6  |   | 1        | 2  | 3  | 4  | 5  | 6  | 7  | 1        | 2  | 3  | 4  | 5  | 6  | 7  |
| 8       | 9  | 10 | 11 | 12 | 13 |   | 8        | 9  | 10 | 11 | 12 | 13 | 14 | 8        | 9  | 10 | 11 | 12 | 13 | 14 |
| 15      | 16 | 17 | 18 | 19 | 20 |   | 15       | 16 | 17 | 18 | 19 | 20 | 21 | 15       | 16 | 17 | 18 | 19 | 20 | 21 |
| 22      | 23 | 24 | 25 | 26 | 27 |   | 22       | 23 | 24 | 25 | 26 | 27 | 28 | 22       | 23 | 24 | 25 | 26 | 27 | 28 |
| 29      | 30 | 31 |    |    |    |   | 29       | 30 | 31 |    |    |    |    | 29       | 30 | 31 |    |    |    |    |

## 1991 TIMETABLES

Refer to Timetable Selector first and then refer to colour coded Time Tables A, B, & C for running times of the trains.

### TIMETABLE A

|               |           |      |      |      |
|---------------|-----------|------|------|------|
| Clarence      | Dep: 1030 | 1215 | 1400 | 1530 |
| Bottom Points | Arr: 1108 | 1253 | 1438 | 1600 |
| Bottom Points | Dep: 1118 | 1303 | 1448 | 1618 |
| Clarence      | Arr: 1154 | 1339 | 1524 | 1654 |

### TIMETABLE B NSW SCHOOL HOLIDAYS

|               |           |      |      |
|---------------|-----------|------|------|
| Clarence      | Dep: 1100 | 1300 | 1500 |
| Bottom Points | Arr: 1138 | 1338 | 1538 |
| Bottom Points | Dep: 1148 | 1348 | 1548 |
| Clarence      | Arr: 1224 | 1424 | 1624 |

### TIMETABLE C TWO TRAIN DAYS

|            |           |      |      |      |      |      |      |
|------------|-----------|------|------|------|------|------|------|
| Clarence   | Dep: 1000 | 1100 | 1200 | 1300 | 1400 | 1500 | 1600 |
| Bottom Pts | Arr: 1045 | 1145 | 1245 | 1345 | 1445 | 1545 | 1615 |
| Bottom Pts | Dep: 1055 | 1155 | 1255 | 1355 | 1455 | 1555 | 1655 |
| Clarence   | Arr: 1138 | 1238 | 1338 | 1438 | 1538 | 1638 | 1738 |

### FARES (as at Jan. 1991)

|                        |       |        |        |
|------------------------|-------|--------|--------|
| Adults:                | ..... | \$8.00 | Return |
| Children:              | ..... | \$4.00 | Return |
| Aged & TPI Pensioners: | ..... | \$6.00 | Return |
| Senior Citizens:       | ..... | \$6.00 | Return |

Special fares are available for groups of 20 or more. Contact (047) 57-3061 during office business hours or write to P.O. Box 33, Woodford NSW 2778.

## HOW TO GET THERE BY TRAIN

(To and from Bottom Points at Zig Zag)

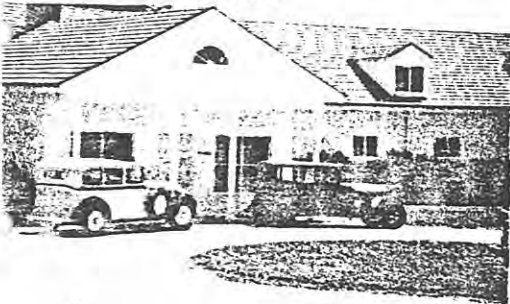
|             | Saturday  | Sunday & Public Hols | Week Days |
|-------------|-----------|----------------------|-----------|
| Sydney      | 0820 0950 | 0820 0920            | 0819      |
| Strathfield | 0835 1005 | 0835 0935            | 0831      |
| Parramatta  | 0846 1016 | 0845 0946            | 0844      |
| Perrin      | 0910 1040 | 0908 1010            | 0908      |
| Katoomba    | 1019 1149 | 1005 1119            | 1017      |
| ZIG ZAG     | 1101 1236 | 1046 1201            | 1059      |
| ZIG ZAG     | 1349 1627 | 1349 1505 1710       | 1419      |
| Katoomba    | 1430 1708 | 1430 1546 1750       | 1500      |
| Perrin      | 1537 1802 | 1537 1640 1844       | 1600      |
| Parramatta  | 1600 1824 | 1600 1702 1905       | 1623      |
| Strathfield | 1614 1836 | 1614 1714 1918       | 1637      |
| Sydney      | 1626 1848 | 1626 1726 1930       | 1649      |

These Timetables are correct at 1.1.91, however they may change during the year.

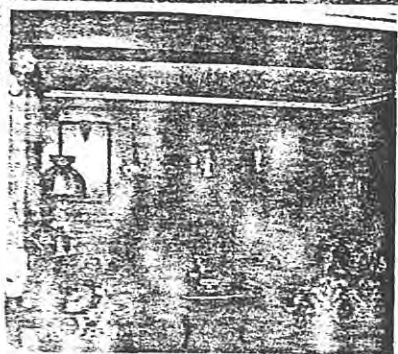
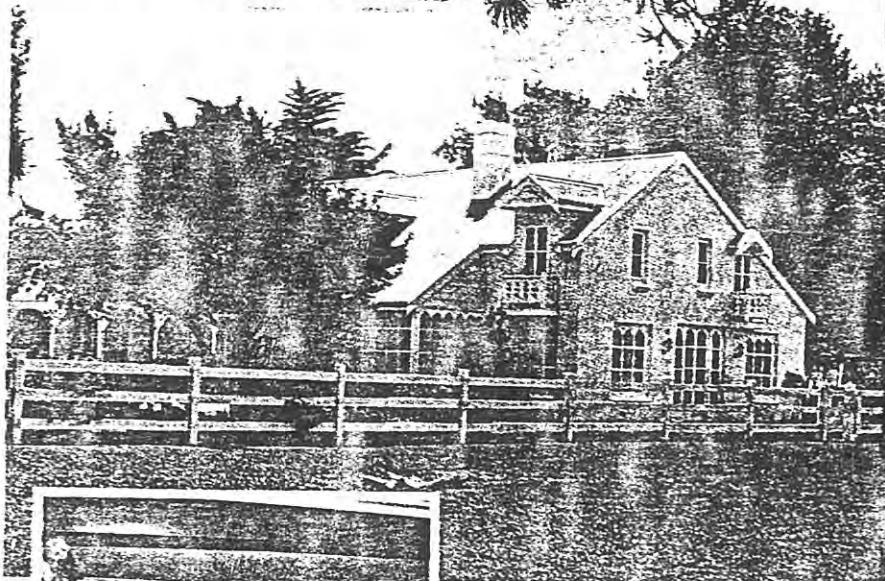
For further information contact the SRA on (02) 954 4422 or (008) 45-1554 (Toll Free)



Below: vintage cars outside Sutton Farm stables; centre and bottom: the homestead.



WITH  
SUELL  
RAPP



## Sutton Farm

**T**UCKED AWAY in picturesque and historic Sutton Forest on the Illawarra Highway, and only minutes from the Hume Highway near Berri-ima, is Sutton Farm Stables.

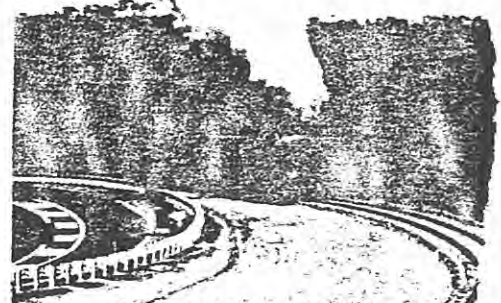
Sutton Farm is owned by partners Don Robinson and Tony Harris. They brought the property in 1979 and have since worked to bring it back to its former grandeur. It was built by convict labour, from the Berri-ima stockade, in the 1820s.

A feature of the farm is the beautiful homestead. Don Robinson still

lives in the house but is happy to take visitors for a tour. Being a keen antique collector the house is full of collection with many pieces imported from all over the world, such as an impressive staircase which was originally installed in a church near Dublin, Ireland. The house also serves as an a-la-carte restaurant where you can dine in Victorian splendour Friday and Saturday nights.

Outside the stable complex a working blacksmith, a coach builder, and harness maker and saddler are practising their trades. Also at the complex is a secure playground area for the children.

Sutton Farm Stables is open 10 am to 5 pm seven days a week. Inspection times for the homestead are 11 am, 2 pm and 3 pm, and for large groups by appointment. There is a \$2 (adults) and \$1 (children) admission fee to the homestead, and the wagon and coach collection. For more information, telephone (048) 68-2584.



Above: Reliving history on the Zig Zag railway.

## Zig Zag railway

**T**HE ZIG ZAG railway was reopened to the public in 1975. Recently extended to the site of the original Clarence station, passengers are now treated to a 13-kilometre return trip through two tunnels, several fern-lined cuttings, beside towering cliffs, and along ledges cut into cliff faces. The view from the majestic viaduct overlooking the three levels of the Great Zig Zag is spectacular.

The Great Zig Zag at Lithgow took three years to complete, being originally opened in 1869. John Whitton, the Engineer in Chief of the NSW Railways, found this was the only practical method of bringing trains from the plateau of the Blue Mountains down into the Lithgow Valley, allowing the railway to then venture to the west of the state. In 1910, the Zig Zag was bypassed by a deviation through ten tunnels and the rails were taken up, to be relaid 65 years later. Today's trains run over civil engineering structures completed 120 years ago.

The Zig Zag Railway is found ten kilometres east of Lithgow on "Bell's Line of Road", the main road west from Richmond.

Trains operate each weekend, on public holidays (except Christmas Day) and on most days of the school holidays. Complete details of running days and timetables can be obtained by ringing (047) 57-3061 during business hours.

## Children's treasure house

**I**MAGINE A place where you can relive your childhood; a place overflowing with old toys and books, some dating back to the 18th century!



# SATURDAY

Sydney TV

1991  
SEPTEMBER 28

## SEVEN

- 6.00 **Cross Country** – Topical.
- 6.30 **Crusader Rabbit** – (Rpt).
- 6.35 **Dynomutt** – (Rpt). Cartoon.
- 7.00 **Saturday Disney** – Cartoons.
- 9.00 **Video Smash Hits** – Music.
- 12.00 **Wombat** – (Rpt). For kids.
- 12.30 **Saturdee** – (Rpt). For kids.
- 1.00 **Saved By The Bell** – Comedy.
- 1.30 **Get Smart** – (Rpt). Spy comedy.
- 2.00 **AFL** – Coverage of the 1991 Grand Final from VFL Park.
- 6.00 **News, Sport And Weather.**
- 6.30 **World Around Us – Blue Mountains Wonderland** (Rpt). Scott Lambert explores the picturesque Blue Mountains of NSW.
- 7.30 **Celebrity Family Feud** – Game.
- 8.00 **Celebrity Wheel Of Fortune.**
- 8.30 **Movies** – (Rpts). **The Light-horsemen** (AO, 87). Dramatisation of the encounter between the Australian and Turkish forces at the city of Beersheba in the North African desert during World War I. With Jon Blake, Peter Phelps, Tony Bonner, Sigrid Thornton.
- 11.15 **2010** (PGR, 84). A mission is launched to investigate a haunting black monolith circling Jupiter. Featuring Roy Scheider, John Lithgow.
- 1.35 **Virginity** (AO, 75). Featuring Vitorrio Gassman.
- 3.05 **Electric Boogaloo: Breakdance II** (84). Rap-dancing drama featuring Lucinda Dickey.
- 4.45 **Lime Street** (PGR). With Robert Wagner.

## NINE

- 6.00 **Thunderbirds** – (Rpt). For kids.
- 7.00 **Cartoon Company** – For kids.
- 8.30 **'C' Company** – Presented by Tony Johnston and Nerida Leishman. Featuring: *The Girl From Tomorrow*, *C'mon Kids*, *Good-sports*, *Bush Beat* and *KTV*.
- 11.00 **Hey Vern, It's Ernest.**
- 11.30 **Movie – Tarzan And The Slave Girl** (50, Rpt, b/w). The people of a village are suffering from a strange disease. With Lex Barker.
- 1.00 **Wide World Of Sports.**
- 5.00 **Burke's Backyard** – (\*S, Rpt).
- 6.00 **News, Sport And Weather.**
- 6.30 **Hey Hey It's Saturday** – With Daryl Somers and Ossie Ostrich.
- 8.30 **Movie – Rio Bravo** (PGR, 59, Rpt). A sheriff and his posse – which consists of an old cripple, an ex-deputy-turned-drunk, a youth who is too fast with his guns, and a girl – try to outsmart a powerful rancher who wants to get his killer brother released from prison. Western featuring John Wayne, Dean Martin, Ricky Nelson, Angie Dickinson and Walter Brennan.
- 11.25 **News.**
- 11.30 **MTV** – (AO). Music program. Presented by Richard Wilkins.
- 2.30 **Movie – Can't Stop The Music** (PGR, 80, Rpt). A famous model creates a group. With Valerie Perrine and The Village People.
- 4.55 **Carson's Comedy Classics.**
- 5.30 **The Sullivans** – (Rpt). Drama.

## TEN

- 6.00 **The Muppet Show** – (Rpt).
- 7.00 **Kids' Stuff** – Presented by Lochie Daddo. Featuring: (7.01) Commander Crumbcake. (7.30) The Muppet Babies. (8.00) Dink The Little Dinosaur. (8.30) Attack Of The Killer Tomatoes.
- 9.00 **Video Hits** – Music clips.
- 12.00 **New Bricks And Mortar** – (Rpt).
- 1.00 **Tennis** – The Queensland Open Championship from Brisbane.
- 5.00 **This Land Australia – Cape York Peninsula: Vanishing Frontier** (Rpt). Featuring Ted Egan.
- 6.00 **News, Sport And Weather.**
- 6.30 **Major Dad** – Comedy series.
- 7.00 **M\*A\*S\*H** – (Rpt). Comedy.
- 7.30 **Shark Bay** – (Debut).
- 8.30 **Movie – Mad Max III: Beyond Thunderdome** (AO, 85, Rpt). Max enters the cutthroat city of Bartertown, where he encounters the evil Aunty Entity, survives a battle-to-the-death and then is exiled to the desert. Drama featuring Mel Gibson, Tina Turner and Angelo Rossitto.
- 10.40 **Tennis** – The 1991 Queensland Open Championships from Milton Courts in Brisbane.
- 1.40 **The Robert Guillaume Show.**
- 2.10 **Movies – Heart** (AO, 85). Drama featuring Philip English.
- 3.40 **Smugglers Island** (PGR, 51, Rpt). Adventure featuring Jeff Chandler and Evelyn Keyes.
- 5.00 **The Hour Of Power** – Religious.

\*

After the general introduction the Lithgow Zig Zag was featured as one of the prime attractions of the Blue Mountains region. Specific reference was made to it being "the engineering wonder of its day"